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(54) **METHODS AND SYSTEMS FOR NETWORK BASED ELECTRONIC PURCHASING SYSTEM**

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Publication Classification

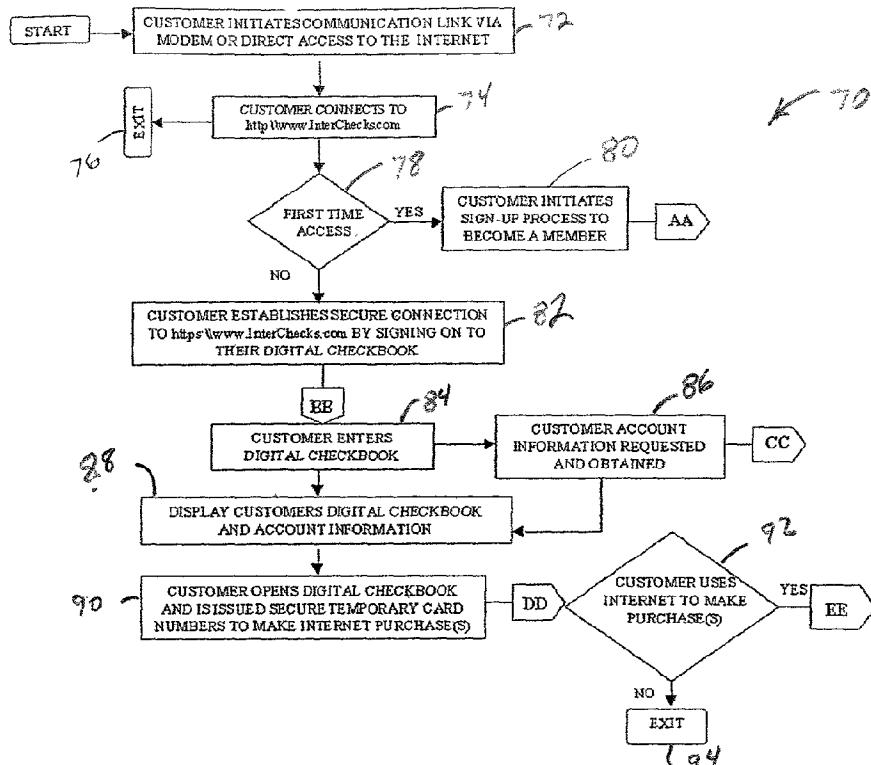
(51) **Int. Cl. 7** **G06F 17/60**
(52) **U.S. Cl.** **705/26**

ABSTRACT

A system and method for providing private and secure electronic purchasing via the Internet is disclosed. The system includes a central computer system which has capabilities to securely communicate with off-site remote access terminals via the Internet. The central computer system also has capabilities to securely communicate with trust bank computers, investment advisor computers and card processing computers. Provided are remote security access, account cross-referencing, omnibus accounting, and debit and credit card number selection. The central computer system is accessed using a computer via the Internet where a user activates a digital checkbook using the computer and sets transaction and time limits using the computer. User account information is accessed by the system, card numbers are selected by the system, and the user account is temporarily linked to the selected numbers by the system. The user never has to expose any personal information to the merchant.

Related U.S. Application Data

(63) Non-provisional of provisional application No. 60/207,693, filed on May 26, 2000.



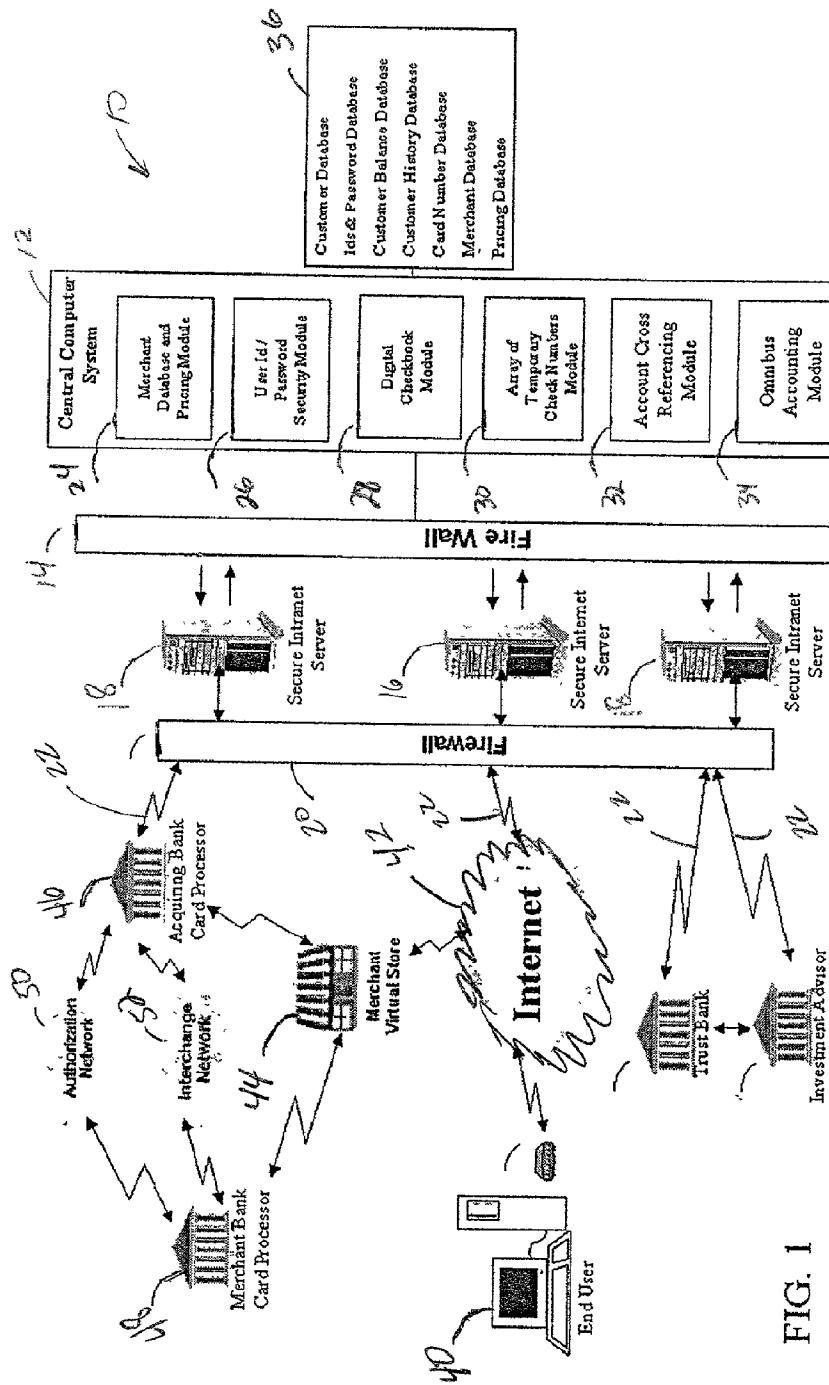


FIG. 1

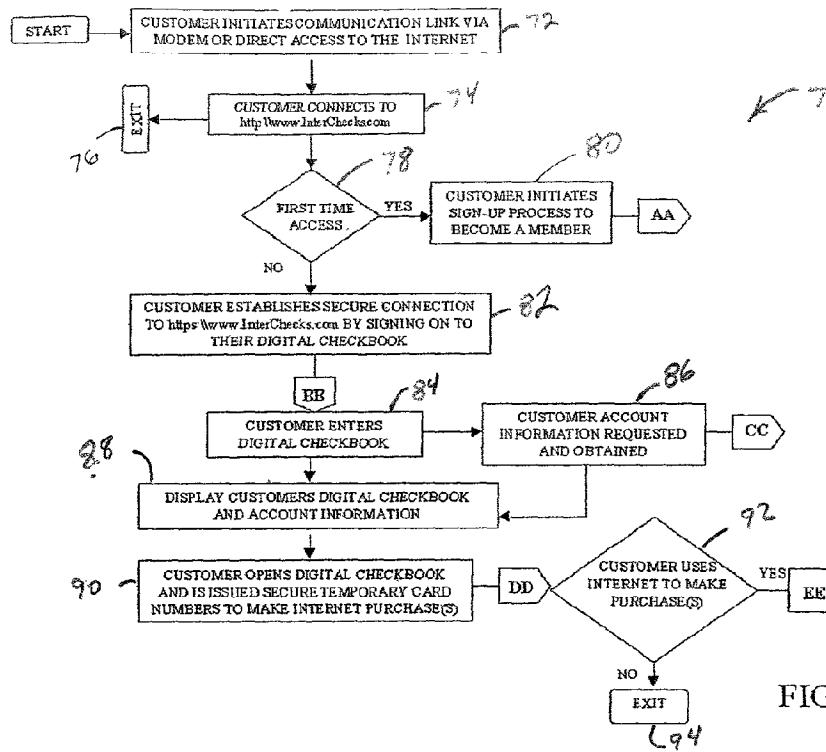


FIG.-2A

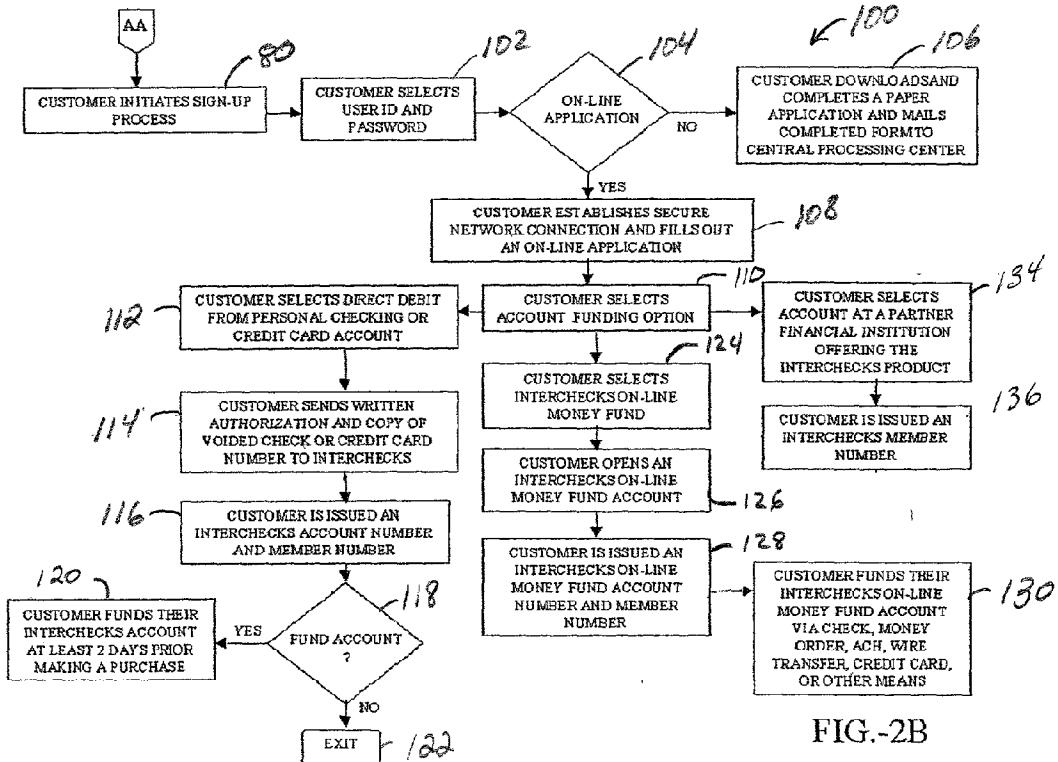


FIG.-2B

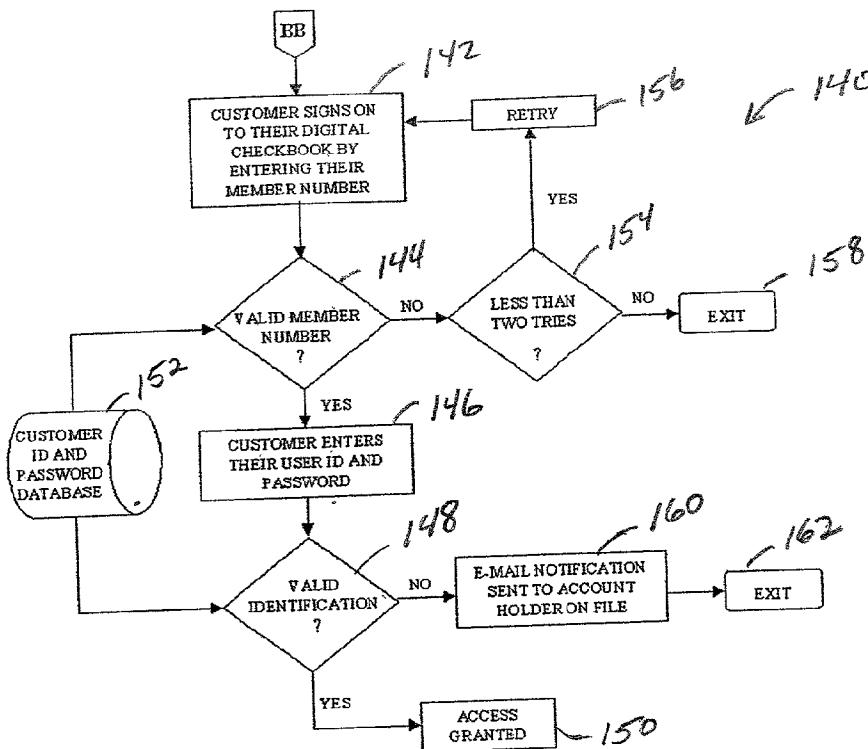


FIG.-2C

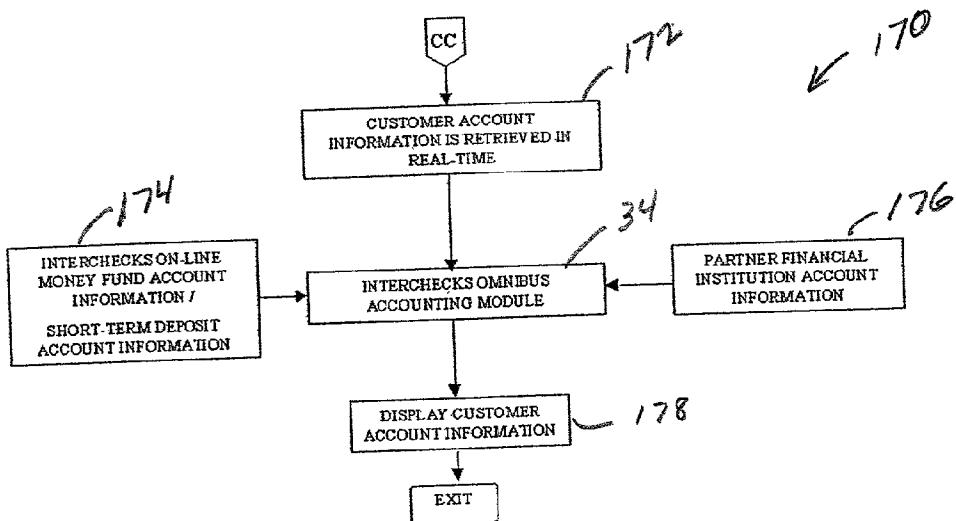


FIG.-2D

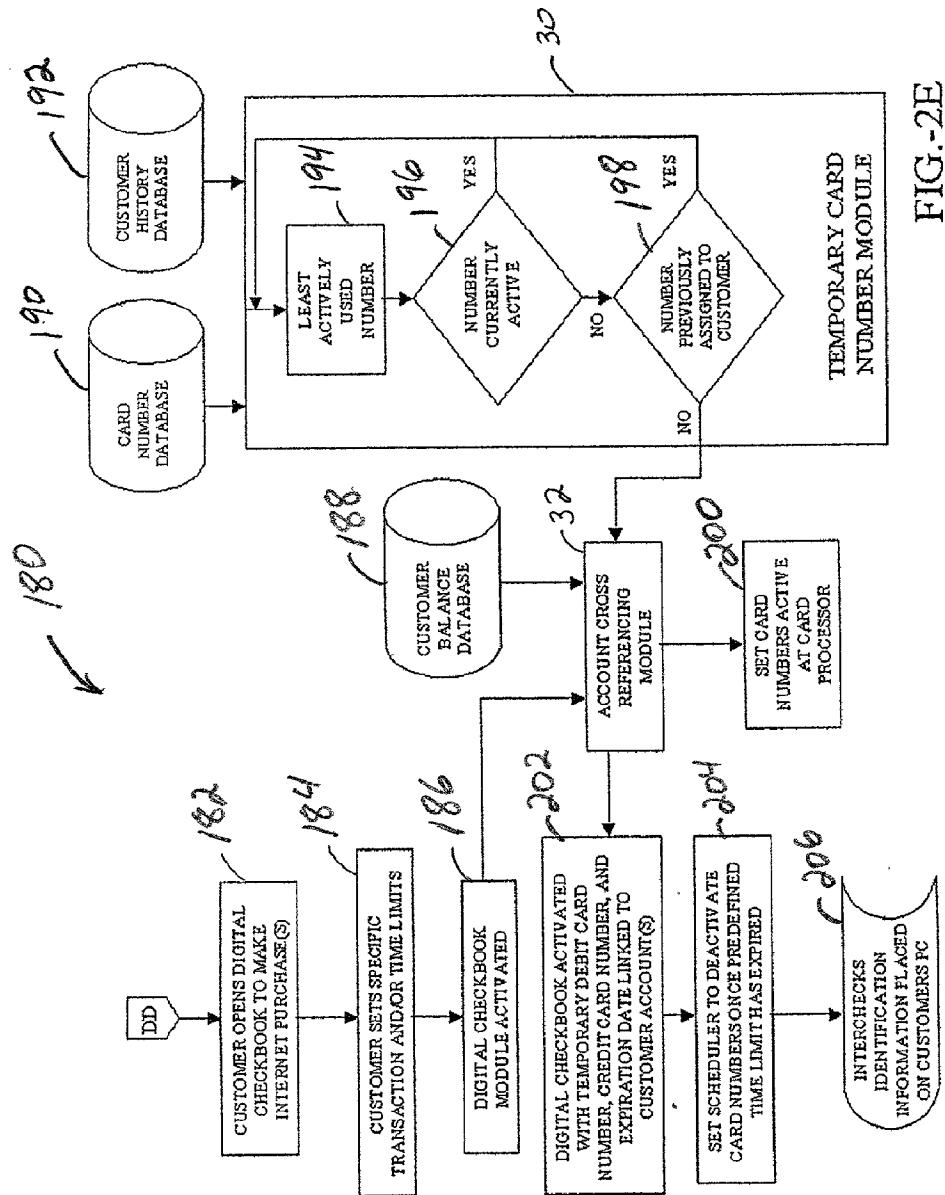


FIG.-2E

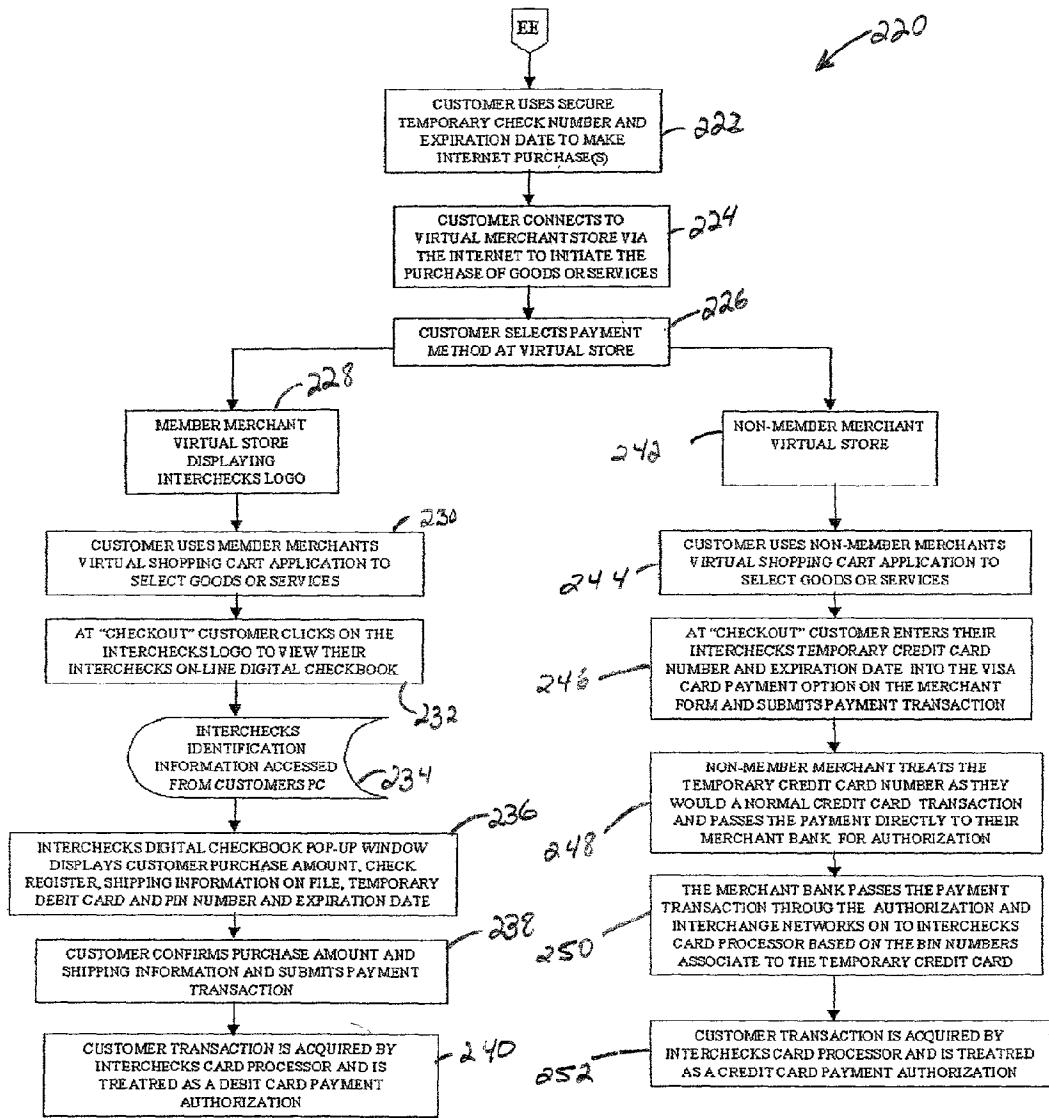
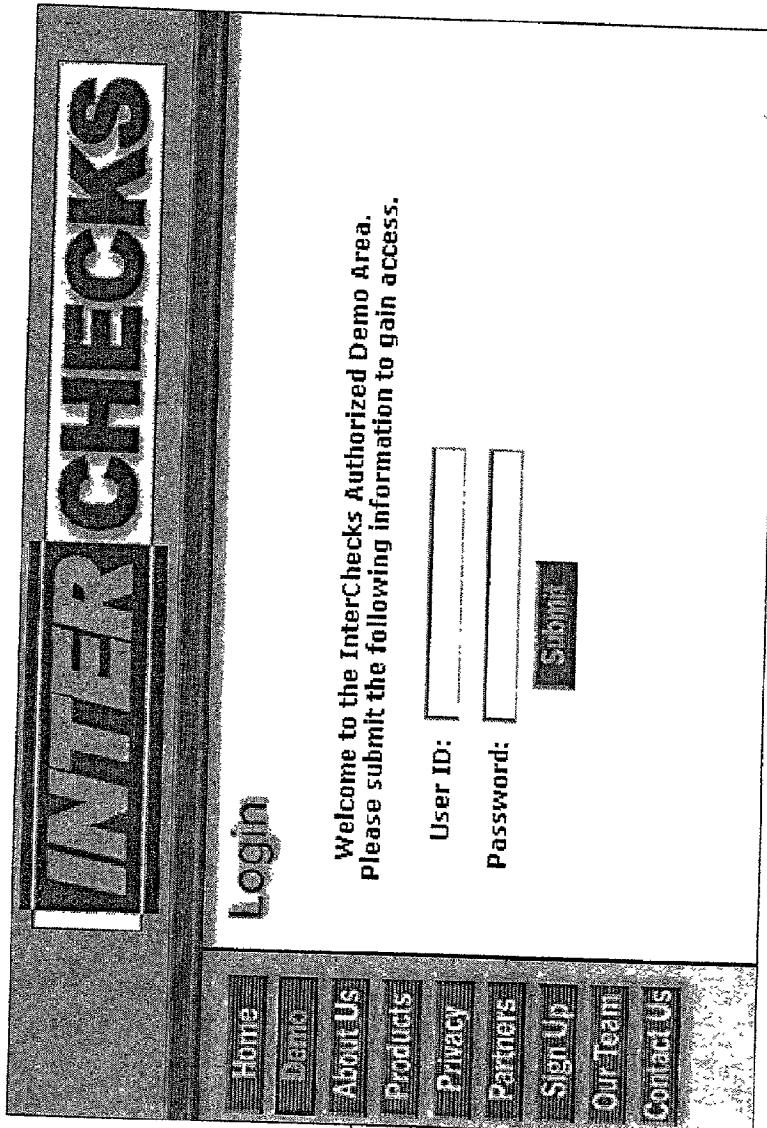


FIG. 2F



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LINK-UP CHECKS

Sign-Up Now

Please note that you must be at least 18 years old to register.

CREATE LOGIN INFORMATION:

User Name: 310
Password: 310
Verify Password: 310

ENTER REQUIRED CONTACT INFORMATION:

First Name: 312
Middle Initial: 312
Last Name: 312
Telephone No.: 312
Email 1: 312
Email 2: 312
Institution: 312
Card Type: 312
Account No.: 312

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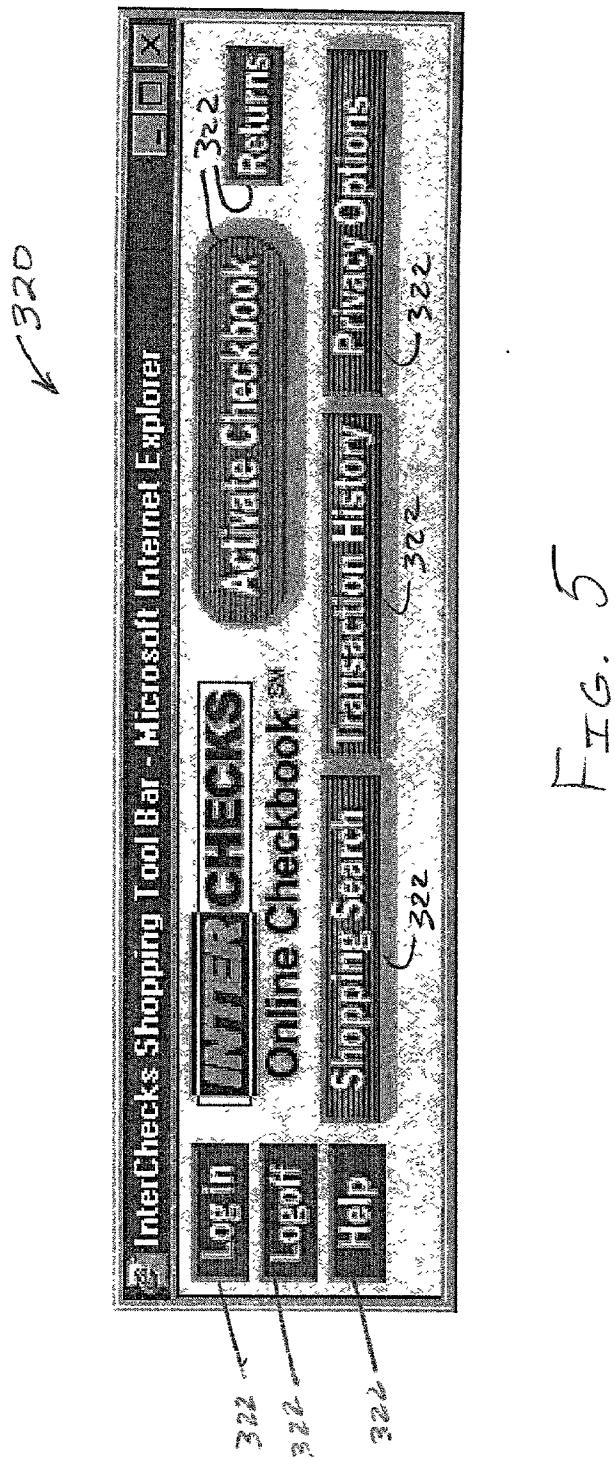
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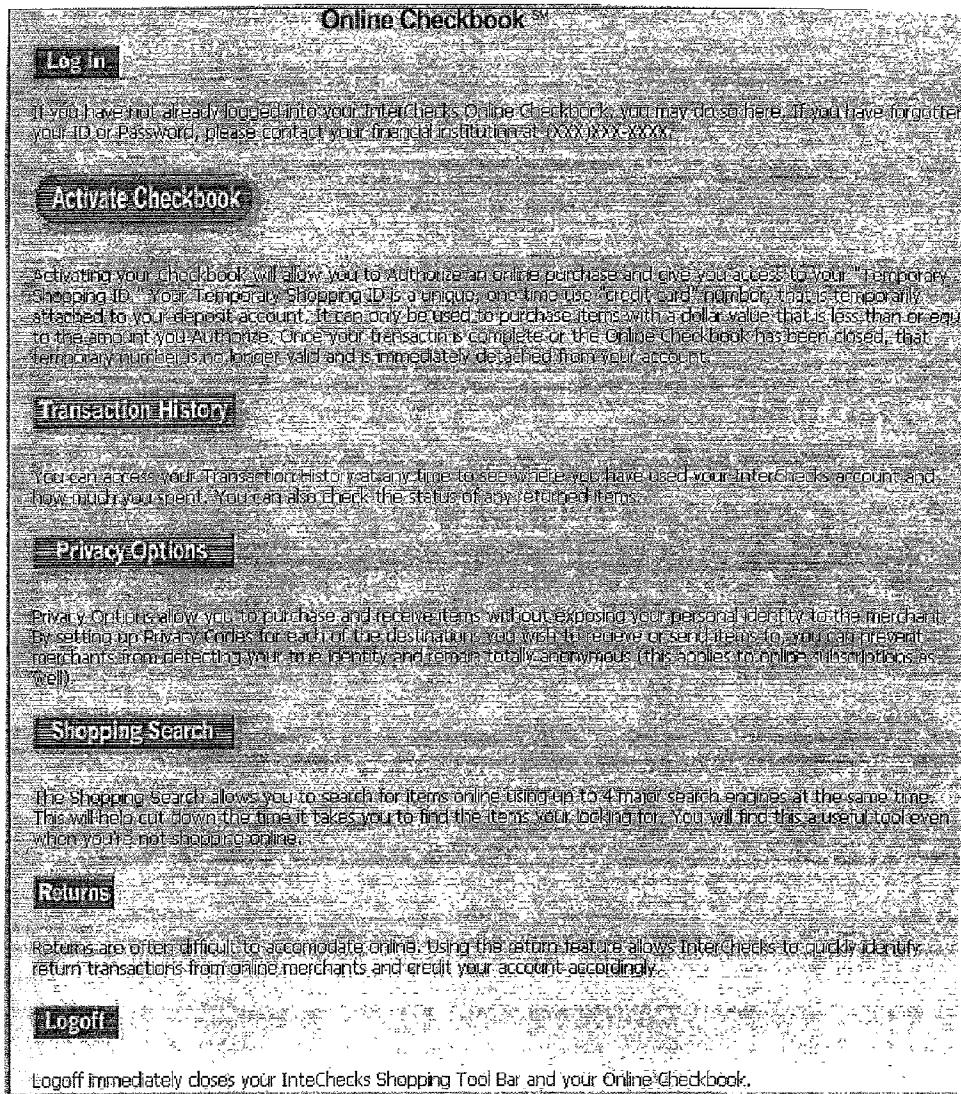


FIG. 6

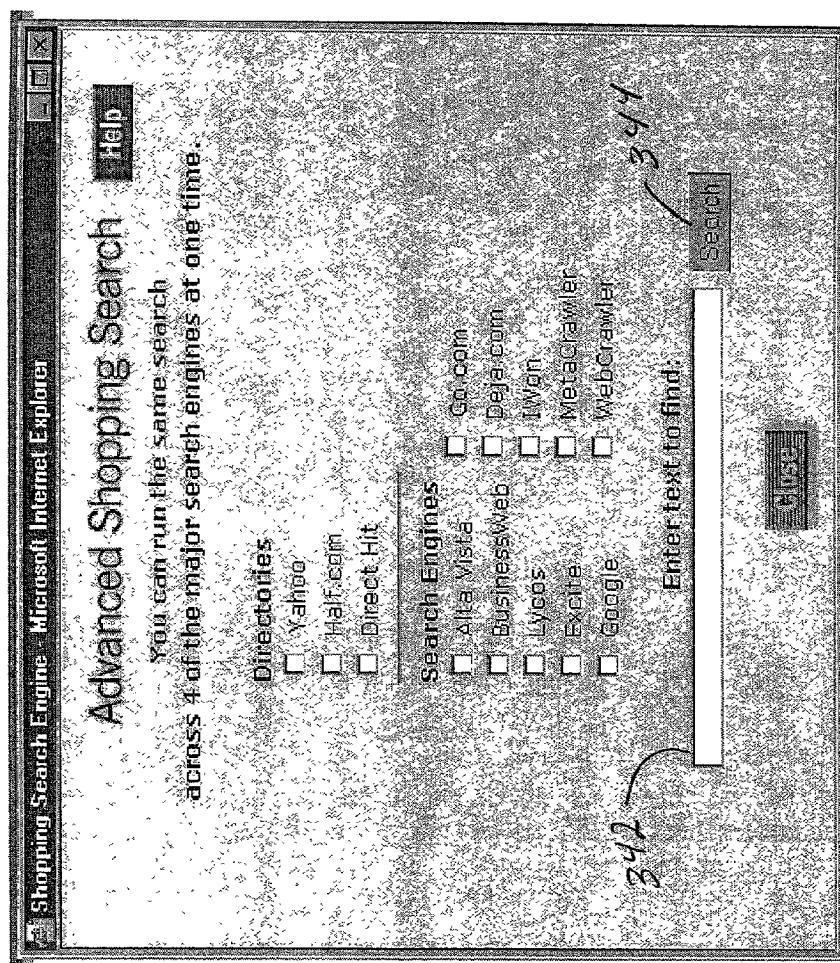
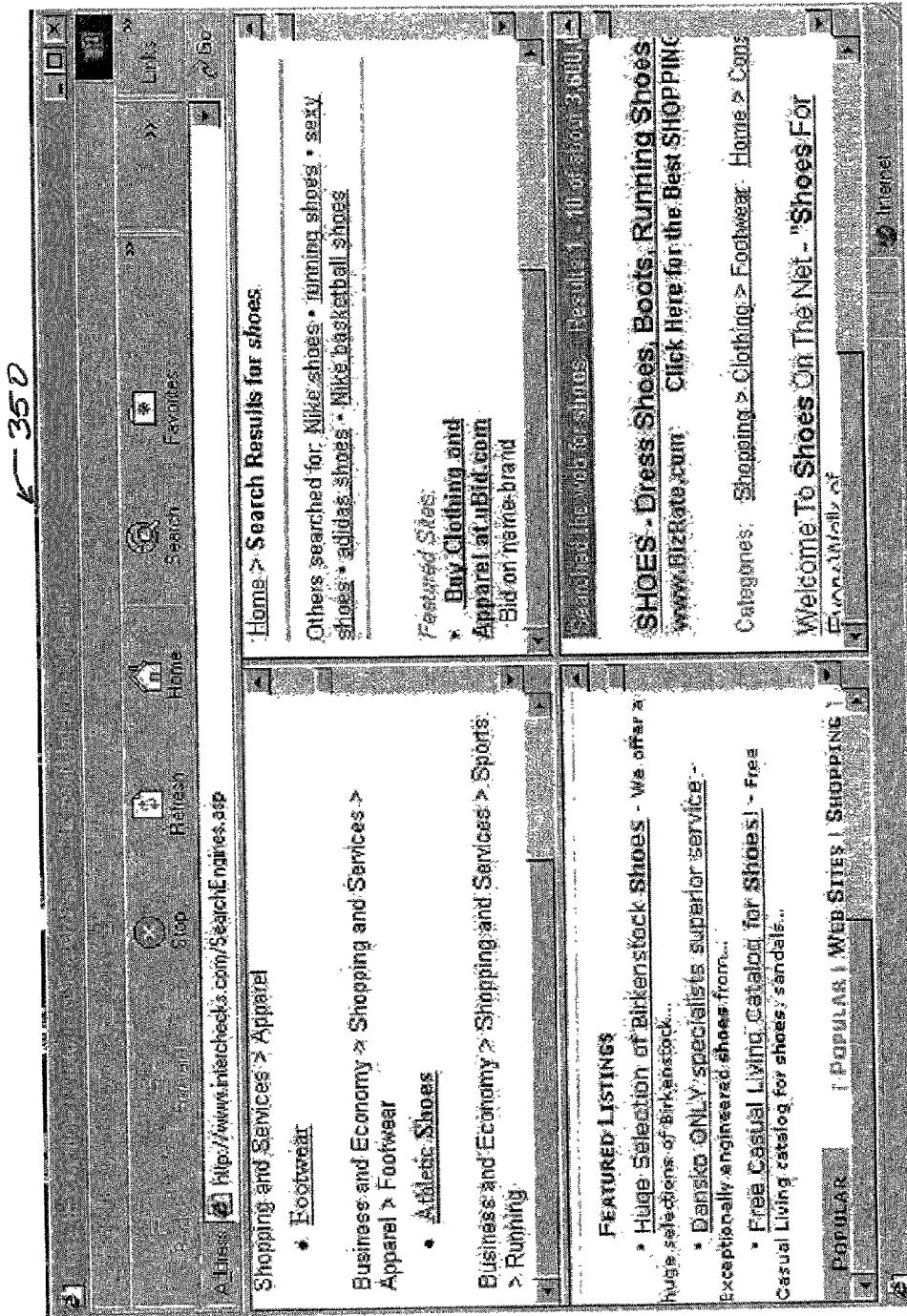


FIG. 7



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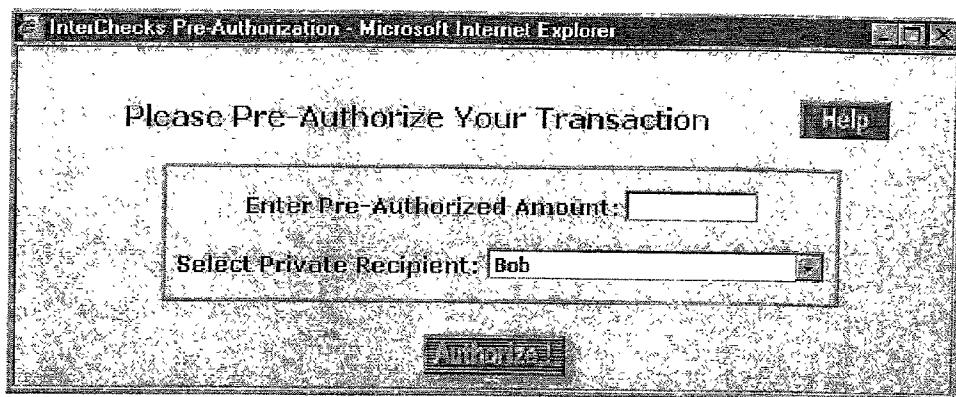


FIG. 9

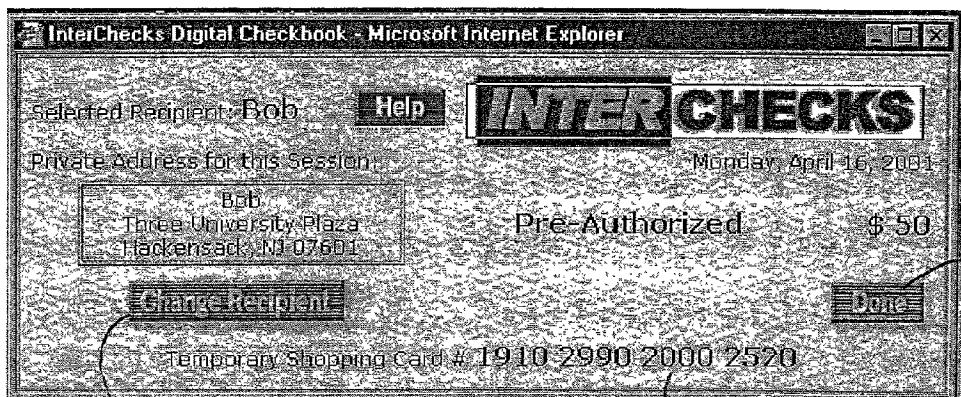


FIG. 10

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Return Confirmation

Sort by: Date

Return	Date	Transaction Description	Amount	Reference Number
<input checked="" type="checkbox"/>	6/27/99	Wall Street Journal	14.95	1002347
<input checked="" type="checkbox"/>	6/25/99	Cell Computer Card	121.86	1002348
<input checked="" type="checkbox"/>	6/25/99	Standard Oil	48.56	1002349

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FIG. 12

Open

←

Date	Description	Amount	Reference Number
6/30/99	Eoddhead Computer Software Company	89.07	1002344
6/30/99	NY Sports Club	35.00	1002345
6/29/99	Shapiro Image - credit	14.10	1002346
6/27/99	Wall Street Journal	14.03	1002347
6/25/99	Dell Computer Corp.	121.86	1002348
6/25/99	Amazon.com	42.56	1002349
6/24/99	Time Magazine	39.99	1002350
6/23/99	Victoria's Secret	152.60	1002351
6/22/99	Co.com	256.25	1002352
6/15/99	Bing Music Service	25.78	1002353

FIG. 13

420

INTER CHECKS

Private Shipping Options

Thank you for signing up at InterChecks.com.
Using the form below, please create a list of recipient by
entering their shipping information.

Alias : 420

Recipient Name :

Address 1 :

Address 2 :

Address 3 :

City :

State :

Zip :

Country :

Telephone No :

Submit

FIG. 14

440

442

INTER CHECKS

Private Shipping Options

Current recipient list found in the InterChecks database:
To add more, click [here](#).

Home Demo About Us Products Privacy
Partners Sign In Our Team Contact Us

1 RECIPIENT(S) FOUND

Recipient Name	Address 1	City	State	Zip	Telephone	Fax
John Doe	123 Main Street	Anytown	CA	90210	(201)555-2345	

ADD ANOTHER RECIPIENT:

Alias :
Recipient Name :
Address 1 :
Address 2 :
Address 3 :
City :
State :
Zip :
Country :
Telephone No :

Fig. 15

METHODS AND SYSTEMS FOR NETWORK BASED ELECTRONIC PURCHASING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/207,693, filed May 26, 2000, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to computerized information management and processing systems, and more specifically to a system and method that facilitates a secure environment for the electronic purchasing of goods and services via the Internet.

[0003] When a consumer connects to the Internet to purchase goods and services from a virtual merchant web site, the customer is commonly required to complete one or more forms which asks for personal as well as credit card payment information. The information entered into these forms often includes such items as credit card number, type of credit card, expiration date of credit card, consumer name, address, city, state, zip-code, home telephone number, and often business telephone number. Any or all of these items may be considered by the consumer to be confidential in nature. As a result, consumers most often abandon their on-line purchases at the point of checkout, unwilling to pass their personal information through the Internet.

BRIEF SUMMARY OF THE INVENTION

[0004] In one aspect of the present invention, a method for facilitating purchasing transactions using the Internet is provided which comprises accessing a secure purchasing system account, funding the account, activating the account for purchasing, setting at least one of a transaction amount limit and a time limit for a purchasing session using the account, receiving temporary card numbers and expiration dates for the numbers that are assigned to the account, and using the temporary card numbers to purchase items over the Internet.

[0005] In another aspect, a system to facilitate secure purchasing via the Internet is provided which comprises a central computer further comprising a digital checkbook module, a merchant database module and a temporary card number module. The system further comprises at least one Internet server coupled to said central computer; and at least one of an Internet and an intranet server coupled to said central computer, and further coupled to an acquiring bank processor, the central computer configured to assign temporary debit and credit card numbers using the temporary card number module, to a checkbook of a registered user, the checkbook located within the digital checkbook module, the temporary card numbers being sent by the system to a merchant, via the Internet, to pay for purchases made by the registered user when accessing a merchant website.

[0006] In still another aspect, a method for operating a computer to facilitate private and secure purchasing transactions is provided which comprises prompting a user to enter a user ID and a password, prompting the user to activate a purchasing session, retrieving user account information and generating at least one of a temporary debit card number and a temporary credit card number for use by the user in a purchasing session.

[0007] In yet another aspect of the present invention, a database is provided which comprises data corresponding to merchants who are partnered with a private and secure purchasing system provider, data corresponding to pricing for transactions, data corresponding to credit card and debit card numbers, data corresponding to users, data corresponding to customer histories, data corresponding to account balances and data corresponding to user IDs and passwords.

[0008] In another aspect a computer is provided which is programmed to verify user entered member numbers and user IDs and passwords against an IDs and passwords database in a security module, verify user account balances, assign at least one temporary debit card number and at least one temporary credit card number to a user for a purchasing session, activate a user account for purchasing connect to at least one merchant web site and transmit at least one temporary card number to a merchant as payment for a purchase.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a functional block diagram of a private and secure Internet purchasing system.

[0010] FIG. 2A is a functional flow diagram showing the overall method of operation of the system shown in FIG. 1.

[0011] FIG. 2B is a functional flow diagram of the initial user sign-up process.

[0012] FIG. 2C is a functional flow diagram of the user sign-on process.

[0013] FIG. 2D is a functional flow diagram of the user account retrieval process.

[0014] FIG. 2E is a functional flow diagram of the user opening their digital checkbook.

[0015] FIG. 2F is a functional flow diagram of the purchasing process.

[0016] FIG. 3 is an example of a user login page.

[0017] FIG. 4 is an example of a user sign-up page.

[0018] FIG. 5 is an example of a shopping tool bar.

[0019] FIG. 6 is an example of a user help page for the online checkbook.

[0020] FIG. 7 is an example of a shopping search page.

[0021] FIG. 8 is an example of a shopping search results page.

[0022] FIG. 9 is an example of a user pre-authorization page.

[0023] FIG. 10 is an example of an authorization page.

[0024] FIG. 11 is an example of a select items to return page.

[0025] FIG. 12 is an example of a returns confirmation page.

[0026] FIG. 13 is an example of a transaction history page.

[0027] FIG. 14 is an example of a shipping options page.

[0028] FIG. 15 is an example of an add recipient page.

DETAILED DESCRIPTION OF THE INVENTION

[0029] FIG. 1 is one embodiment of an Internet based system 10 according to the present invention. Referring specifically to FIG. 1, system 10 includes a central computer system 12, connected through a firewall 14 to at least one Internet server 16 and at least one intranet server 18. Internet servers 16 and intranet servers 18 are connected to a second firewall 20 which provides communications interface 22 with outside entities. Central computer system 12 receives input signals and transmits output signals over various communications channels and also includes the capability to communicate bi-directionally with other computers as well as the capability to access databases as further described below. Telephone lines and the Internet are used as the primary communications links.

[0030] Central computer system 12 includes a plurality of modules and databases for providing private and secure purchasing for registered users via the Internet. In one embodiment, in central computer system 12 includes a merchant database and pricing module 24, a user ID/password security module 26, a digital checkbook module 28, a temporary card numbers module 30, an account cross-referencing module 32 and an omnibus accounting module 34. Further included within central computer system 12 is a database unit 36 which includes a plurality of databases, described below and including, in the embodiment shown, a customer database, an IDs and passwords database, a customer balance database, a customer history database, a card number database, a merchant database, and a pricing database. In other embodiments, database 36 is located external to central computer system 12.

[0031] As stated above, central computer system 12 is configured to provide private and secure purchasing for registered users. A person using a user computer 40 connects to the Internet 42 through any of a variety of known methods and connects to a web site hosted on Internet server 16 and proceeds to register to become a registered user and to set up user accounts and balances. Once a registered user, the person is able to access their account to make purchases, for example, from a merchant web site hosted on merchant computer 44, via Internet 42.

[0032] A merchant is either partnered with the private and secure purchasing provider, or they or not. For merchants partnered with the private and secure purchasing provider, transactions for Internet purchases are treated as debit card transactions by an acquiring bank card processor 46 which is connected through a network, intranet or Internet, to merchant computer 44 and central computer system 12. For merchants not partnered with the private and secure purchasing provider, transactions for Internet purchases are treated as credit card transactions. For such merchants, merchant computer 44 is configured to relay information regarding the transaction to a merchant bank card processor 48, which relays the transaction information, via an authorization network 50 to acquiring bank card processor 46 which is connected to central computer 12 through a secure network. After verification of sufficient account funding, acquiring bank card processor 46 transmits an approval or denial over authorization network 50 and funds are transferred from acquiring bank card processor 46 to merchant bank card processor 48 via an interchange network 52. By

partnering with the private and secure purchasing provider, merchants and financial institutions, for example, acquiring bank card processor 46, are able to access and provide per-transaction debit card pricing for the service, rather than credit card pricing.

[0033] In one embodiment, member merchants have a button on their website which allows processing of purchases using a customized form. The form is populated by accessing the identification output file placed on the user computer 40 by central computer system 12 and filling the fields with the necessary purchasing information including the users temporary debit card number. The process allows the merchant to access special per-transaction debit card pricing rather than credit card pricing as described above.

[0034] FIG. 2A is a flowchart 70 which diagrams procedures executed by and implemented in central computer system 12 of system 10 (shown in FIG. 1). After a user initiates 72 Internet access, they choose to connect 74 to the private and secure purchases provider web site. The user may choose to exit 76 at this time. Alternatively, if the user chooses to continue, they are queried 78 if they are accessing central computer system 12 for the first time. If the user is accessing for the first time, a sign up process is initiated 80 which is described in further detail in FIG. 2B below. If not accessing for the first time, the user establishes 82 a secure connection to the private and secure purchases provider web site, and enters 84 their digital checkbook, which is described in further detail in FIG. 2C below.

[0035] The user then chooses whether to request and obtain 86 account information or to display 88 their checkbook with account information. After account information is requested and obtained 86, the checkbook with account information is displayed 88. After display 88 of checkbook with account information, the user opens the checkbook and is issued 90 secure temporary card numbers, both debit and credit, for Internet purchases, which are described in further detail in FIG. 2E below. After temporary card numbers are issued 90, the user chooses 92 whether or not to make purchases via the Internet. The user exits 94 if no purchasing is to be done at this time. Internet purchasing is further described in FIG. 2F below.

[0036] FIG. 2B is a flowchart 100 which shows steps followed when a user initiates 80 (also shown in FIG. 2A) a sign up process. First, the user selects 102 a user ID and a password, and then selects 104 whether an application will be completed online or off line. If off line, the user downloads 106 a paper application and mails the completed application to a central processing center (not shown). If the application is to be completed online, the user establishes 108 a secure network connection and completes an online application. In completing the application, online or off line, the user selects 110 an account funding option. Two funding options are a selection 112 of a direct debit from a personal checking account or selection 112 of a charge to a credit card account. Upon such a selection 112, the user sends 114 a written authorization and a copy of a voided check or a credit card number to the private and secure purchasing system provider. After processing is completed, the user is issued 116 a secure purchasing provider account number and member number. If the user chooses to fund 118 their account at this time, they fund 120 their private and secure account, otherwise the user exits 122 the web site.

[0037] The user may select 124 a private and secure purchasing provider online money fund as their preferred method of funding their account for Internet purchases. To fund an account for Internet purchases in this manner, the user opens 126 a private and secure purchasing provider online money fund account. After opening 126 the account, the user is issued 128 a private and secure purchasing provider online money fund account number. To fund 130 the online money fund account, the user provides the private and secure purchasing provider funds via one of check, money order, ACH, wire transfer and credit card, for example. Of course, other funding vehicles may be used to fund the account. After funding the online money fund account, the user exits 132.

[0038] A further method for funding a user account is by selecting 134 to have an account at a financial institution that has partnered with the private and secure purchasing provider to provide purchasing accounts, for example, acquiring bank card processor 46 (shown in FIG. 1). When the account is opened at the financial institution, the user is issued 136 a private and secure purchasing provider member number.

[0039] FIG. 2C is a flowchart 140 which further illustrates of a process where a user signs on and activates their digital checkbook. A user signs on by entering 142 their private and secure purchasing provider member number. If the entered membership number is valid 144, the user is instructed to enter 146 their user ID and password. If the user ID is valid 148, access is granted 150. User IDs and membership numbers are provided in a database 152, which is part of database 36 (shown in FIG. 1). If an invalid member number is entered, and the number of attempts to enter the digital checkbook is below 154 a threshold, the user may retry 156 entering the digital checkbook, otherwise central computer system 12 (shown in FIG. 1), disconnects the user, forcing an exit 158. If a membership number entered 142 is valid 144, but the user ID entered 146 is not valid 148, an E-mail notification is sent 160 to the account holder of record, and central computer system 12 exits 162.

[0040] FIG. 2D is a flowchart 170 which illustrates a process for account information retrieval. First, after entering 84 (shown in FIG. 2A) the digital checkbook, user account information is retrieved 172 in real time and copied to omnibus accounting module 34 (also shown in FIG. 1). Depending on the funding option previously selected, money fund account information and short-term deposit account information 174 and/or partner financial institution account information 176 are copied to accounting module 34. Omnibus accounting module 34 then causes central computer system 12 to display 178 user account information.

[0041] FIG. 2E is a flowchart 180 illustrating opening and activation of the digital checkbook for making Internet purchases. A user which has successfully entered the private and secure purchasing provider system by entering a valid member number and user ID/password, opens 182 their digital checkbook, which is a register of the member's account, to make Internet purchases. The user then sets 184 at least one of specific transaction limits or time limits on the purchasing session. The digital checkbook module 28 (shown in FIG. 1) is then activated 186. Notification of the activation is sent to account cross referencing module 32

(also shown in FIG. 1). Further, a customer account balance is sent to account cross referencing module 32 from a customer account database 188 within database 36 (shown in FIG. 1). Also sent to account cross referencing module 32 is a temporary card number used for making the purchases. The temporary account number is generated based on information within card number database 190 and customer history database 192, both within database 36. Temporary card number module 30 (also shown in FIG. 1) determines 194 a least active card number within database 190 and determines 196 if the number is currently active. If active, module 30 determines another card number that has been inactive the longest amount of time. The process is repeated until a card number that is currently inactive is identified. Once a inactive card number is determined 196, module 30 determines 198 if the particular card number has ever been assigned to that user in a previous purchasing session. If so, the process above is repeated until an inactive card number that has never been assigned to the particular user is identified. The temporary card number is then sent to account cross referencing module 32, which activates 200 the temporary card numbers by sending instructions to a card processor, for example, acquiring bank card processor 46 (shown in FIG. 1) to activate the card numbers.

[0042] The digital checkbook is then activated 202 with a temporary debit card number, a temporary credit card number, and an expiration date all of which are linked to the user account. A scheduler is then set 204 to deactivate the card numbers, debit and credit, once one of a pre-defined time limit has expired or a transaction amount limit has been exceeded. User account information, for example, account balance and card numbers, is placed 206 on user computer 40 (shown in FIG. 1) in the form of an identification output file, from central computer system 12 (shown in FIG. 1).

[0043] FIG. 2F is a flowchart 220 illustrating using 222 the temporary card numbers and expiration dates of the card numbers to make Internet purchases. Referring specifically to flowchart 220, the user connects 224 to merchant computer 44 (shown in FIG. 1) to shop and make selections for purchase via the Internet. After making their selections, the user selects 226 a payment method, depending on whether the merchant is partnered with the private and secure purchasing provider. If so partnered, the virtual store displays 228 a logo of the private and secure purchasing provider. The user then uses 230 a member merchant's virtual shopping cart application to select goods and services. When ready to "check out" the user selects 232 the logo of the private and secure purchasing provider to view their online digital checkbook. Information from the identification output file is then uploaded 234 from user computer 40 (shown in FIG. 1) to merchant computer 44. A digital checkbook pop-up window is displayed 236 which includes a user purchase amount, a check register, shipping information that is on file, a temporary debit card and pin number, and expiration date. The user then confirms 238 the purchase amount and shipping information and submits a payment transaction. The user transaction is acquired 240 by a private and secure purchasing provider processor and is treated as a debit card payment authorization.

[0044] If the merchant is not partnered with the private and secure purchasing provider, shopping at the non-member merchant virtual store 242 is as follows. The user then uses 244 a member merchant's virtual shopping cart appli-

cation to select goods and services. When ready to "check out" the user enters 246 their private and secure purchasing provider temporary credit card number and expiration date into the credit card payment option on the merchant's payment form and submits the payments transaction. The non-member merchant treats the temporary credit card number as a normal credit card transaction and passes 248 the payment directly to their merchant bank for authorization.

[0045] The merchant bank passes 250 the payment transaction through authorization and interchange networks onto the private and secure purchasing provider based on BIN numbers associated with the temporary credit card. The user transaction is acquired 252 by a private and secure purchasing provider processor and is treated as a credit card payment authorization.

[0046] Operation of such a private and secure purchasing system as described above is further described using exemplary displays which are displayed by central computer system 12 at user computer 40 and described below.

[0047] FIG. 3 is an embodiment of a user login screen 300. Screen 300 is displayed on user computer 40 (shown in FIG. 1) when a person accesses central computer system 12 via Internet 42 and through Internet server 16. Persons who are registered users may simply enter and submit their pre-selected username and password to begin private and secure Internet shopping. If not a registered user, the person who has accessed login screen 300, may select a sign up button in selection bar 302 to register, as described below.

[0048] FIG. 4 is an exemplary embodiment of a user registration page 310, which is displayed upon selection of the sign up button on page 300 (shown in FIG. 3). Page 310 includes data entry fields 312 where a user wishing to register enters such items as a selected username and password, personal identification data, email addresses and account data, to which their future secure purchases will actually be charged against, for example, a bank checking or savings account or a personal credit card. In one embodiment, a registered user will pre-fund a deposit account for their future purchases. Selecting an apply button 314, uploads the user entered information to central computer system 12 for new account processing.

[0049] FIG. 5 is an exemplary embodiment of a start page 320, which is displayed to a user upon a successful login. Page 320 provides the registered user with choices such as activating their digital checkbook, performing a search, viewing a transaction history, setting privacy options, and performing returns, all described below. In one embodiment of start page 320, the user choices are configured as selectable icons 322.

[0050] FIG. 6 is a help page 330 which displayed upon selection of a help option within start page 320 (shown in FIG. 5). Page 330, in the embodiment shown, includes descriptions for logging in and logging off, activating the digital checkbook, viewing transaction histories, privacy options, the shopping search and returns. In addition, the descriptions are headed by selectable icons 322 (also shown in FIG. 5) which, when selected, activate the particular function, for example, a transaction history.

[0051] FIG. 7 is an exemplary embodiment of a shopping search page 340. Search page 340 allows a user to search for their desired purchase using one or more of the popular

search engines and directories available on the Internet. To perform the search the user selects which of the search engines and directories they wish to use, then a purchase item, for example, "shoes" is entered into a text box 342, and a search is initiated by selection of a search button 344 and displayed on a search results page 350, as shown in FIG. 8, which is displayed upon completion of the search as entered into shopping search page 340. It is to be noted that selection of search button 344 initiates searches on all of the selected search engines and directories, and that the item to be searched for, "shoes", for example, is entered by the user only once for search results for all of the search engines and directories.

[0052] Referring specifically to FIG. 8, search results for a plurality of the well-known search engines and directories are displayed on a multiple frame, search results page 350. Search results within each frame are displayed and hyperlinks within the frames are selectable. Selection of a hyperlink within a frame causes a browser window to open and display the selected hyperlink.

[0053] FIG. 9 is an exemplary embodiment of a pre-authorization transaction page 360 which is displayed upon selection of an item for purchase from shopping results page (not shown). To pre-authorize a transaction, the registered user enters an amount to be authorized, and further enters a recipient of the authorized amount. The transaction is not authorized until the user selects an authorize button 362. In addition, a registered user is able to select a recipient which is another person or which may be an alias for the registered user as described in FIG. 14 below.

[0054] FIG. 10 is an exemplary embodiment of an authorization page 370 for the transaction. The transaction, and therefore the purchase, is not completed until the user checks the information within authorization page 370 for correctness and completeness. Selection of a done button 372, authorizes the purchase, and further causes the merchant to be notified of the purchase, in the form of a transmission to merchant computer 44 (shown in FIG. 1). Notification of the purchase includes presenting the merchant with payment for the items purchased, that is, sending temporarily valid card number 374 to merchant computer 44, which causes card number 374 to be processed through card processors 46 and 48 as described above. Selection of done button 372 further causes the user's deposit account to be reduced by the purchase amount. If upon review of page 370, the user wishes to change a previously selected recipient, a change recipient button 376, causes, upon selection, an availability to the user for a change of recipient. Entry of recipient information for storage in central computer system 12 (shown in FIG. 1) is described in FIGS. 14 and 15 below.

[0055] FIG. 11 is an exemplary embodiment of a returns page 380. Upon selection of the returns option on page 320 (shown in FIG. 5), central computer system 12 (shown in FIG. 1) causes returns page 380 to be displayed. Page 380 includes dates, descriptions, amounts, and reference numbers for recent transactions. Transactions are further sortable by any one of date, reference number, amount and description of transaction. A user is able to select any one or a number of transactions for return by selection of a return checkbox for each transaction. Selection of a return button 382 causes a return confirmation page to be displayed.

[0056] FIG. 12 is an exemplary embodiment of a return confirmation page 390. Page 390 displays all of the items

selected for return, in the same format, as page 380 (shown in **FIG. 11**). Selection of a confirm button 392 causes central computer system 12 to notify the merchants of the return and further enters a credit to the user's deposit account. A cancel button 394 causes a cancellation of the contemplated returns. As described for page 380, page 390 allows a user to sort items marked for return by any of date, description, amount and reference number.

[0057] **FIG. 13** is an exemplary embodiment of a transaction history page 400. Upon selection of the transactions history option on page 320 (shown in **FIG. 5**), central computer system 12 (shown in **FIG. 1**) causes returns page 380 to be displayed. Page 400 includes dates, descriptions, amounts, and reference numbers for transactions. Transactions displayed on page 400 are further sortable by any one of date, reference number, amount and description of transaction, as selected by the user. A length of the transaction history displayed is further selectable by the user. As shown on page 400, the history displayed is the last 10 transactions. Smaller or larger numbers of transactions can be selected by the user.

[0058] **FIG. 14** is an exemplary embodiment of a private shipping options page 420. Shipping options page 420 allows a registered user to enter shipping information, for example, name, address and telephone number for storage in database 36 of central computer system 12 (both shown in **FIG. 1**) for recipients of a registered user's online purchases. In addition, shipping options page 420 allows a user to enter an alias for each recipient. The alias is supplied to merchants when purchasing items from a merchant's virtual store. In addition to allowing a user of the private and secure purchasing system anonymity when shopping, using aliases allows a user to purchase gifts for others, whose aliases and shipping information the user has previously stored within database 36, without providing the other's names.

[0059] Aliases are stored within database 36 after entry of the shipping information and selection of an Add button 422. Referring to **FIGS. 9 and 10**, a user is able to select from their listing of stored aliases when pre-authorizing a transaction, by selecting a private recipient, or after authorization using change recipient button 376. Selected aliases are part of the identification output file (described above) which is transferred from central computer system 12 to user computer 40 and sent to merchant computer 44 (all shown in **FIG. 1**) when the user makes a purchase from the merchant.

[0060] **FIG. 15** is an exemplary embodiment of an add recipient page 440, where the registered user is able to view a current recipient list 442, including aliases, and can add additional recipients in the same manner as recipients are added on shipping options page 420 (shown in **FIG. 14**).

[0061] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.

What is claimed is:

1. A method for facilitating purchasing transactions using the Internet, said method comprising the steps of:

- accessing a secure purchasing system account;
- funding the account;
- activating the account for purchasing;

setting at least one of a transaction amount limit and a time limit for a purchasing session using the account; receiving temporary card numbers and expiration dates for the numbers that are assigned to the account; and using the temporary card numbers to purchase items over the Internet.

2. A method according to claim 1 wherein said step of accessing a secure purchasing system account further comprises the step of:

- establishing a secure connection to a private and secure purchases provider web site; and
- receiving an account number and a member number from the private and secure purchasing system account provider.

3. A method according to claim 1 wherein said step of funding the account further comprises the step of selecting a funding option.

4. A method according to claim 3 wherein said step of selecting a funding option comprises the step of selecting at least one of a direct debit from a checking account, a credit card account, a private and secure purchasing provider online money fund, and an account at a financial institution offering the private and secure purchasing product.

5. A method according to claim 4 wherein, for a direct debit from a checking account, said step of funding the account comprises the step of sending a written authorization and a copy of a voided check to the private and secure purchasing provider.

6. A method according to claim 4 wherein, for a credit card account, said step of funding the account comprises the step of sending the credit card number to the private and secure purchasing provider.

7. A method according to claim 4 wherein, for a private and secure purchasing provider online money fund, said step of funding the account comprises the step of sending at least one of a check, a money order, an ACH, a wire transfer, and a credit card number to fund the account.

8. A method according to claim 1 wherein said step of activating the account for purchasing further comprises the steps of:

- entering a valid member number;
- entering a valid user ID and password;
- selecting a recipient for purchases; and
- receiving user account information.

9. A method according to claim 8 wherein said step of selecting a recipient for purchases comprises the step of selecting an alias as the recipient, the alias including shipping information to be supplied to a merchant, the alias not providing the identity of the recipient to the merchant.

10. A method according to claim 8 wherein said step of receiving user account information further comprises the step of receiving an account balance.

11. A method according to claim 1 wherein said step of receiving temporary card numbers further comprises the steps of:

- receiving a temporary debit card number for purchases from merchants who are partnered with the private and secure purchasing provider; and

receiving a temporary credit card number for purchases from merchants who are not partnered with the private and secure purchasing provider.

12. A method according to claim 11 wherein said step of using the temporary card numbers to make Internet purchases further comprises the steps of:

- connecting to a merchant web site;
- selecting at least one of goods and services for purchase;
- selecting a private and secure purchasing provider logo from a partnered merchant web site; and
- confirming at least one of a purchase amount and shipping information; and
- submitting a payment transaction as a debit card transaction.

13. A method according to claim 11 wherein said step of using the temporary card numbers to make Internet purchases further comprises the steps of:

- connecting to a merchant web site;
- selecting at least one of goods and services for purchase;
- entering the temporary credit card number and expiration date into a credit card payment option at the merchant web site;
- confirming at least one of a purchase amount and recipient information; and
- submitting the payment as a credit card transaction.

14. A method according to claim 13 wherein said step of confirming recipient information comprises the steps of:

- electing to change a previously selected recipient; and
- selecting a new recipient from a list of aliases, shipping information for each alias being contained in an output information file.

15. A system to facilitate secure purchasing via the Internet comprising:

- a central computer further comprising:
- a digital checkbook module;
- a merchant database module; and
- a temporary card number module;
- at least one Internet server coupled to said central computer; and
- at least one of an Internet and an intranet server coupled to said central computer, and further coupled to an acquiring bank processor, said central computer configured to assign temporary debit and credit card numbers using said temporary card number module, to a checkbook of a registered user, the checkbook located within said digital checkbook module, the temporary card numbers being sent by said system to a merchant, via the Internet, to pay for purchases made by the registered user when accessing a merchant website.

16. A system according to claim 15 wherein said temporary card number module is configured to:

- access a card number database to select at least one inactive credit card number and at least one debit card number; and

access a customer history database to determine which card numbers to allocate for a session.

17. A system according to claim 16 wherein to access a customer history database to determine which card numbers to allocate said temporary card number module configures said central computer to:

- select a least actively used credit card number and debit card number;
- determine if the selected card numbers are currently active for any other users; and
- determine if the selected card numbers have been previously assigned to the user.

18. A system according to claim 17 wherein said central computer is configured to deactivate debit and credit card numbers as soon as a time limit on a purchasing session has expired.

19. A system according to claim 15 wherein said central computer further comprises a merchant database and pricing module configured to identify merchants which are partnered with the private and secure purchasing provider.

20. A system according to claim 19 wherein said central computer system is configured to:

- charge debit card rates for transactions to merchants who are partnered with the private and secure purchasing provider; and

- charge credit card rates for transactions to merchants who are not partnered with the private and secure purchasing provider.

21. A system according to claim 15 wherein said central computer further comprises a user identification module configured with at least one of member numbers, user IDs and passwords, and recipient information for registered users.

22. A system according to claim 21 wherein said central computer is configured to assign member numbers to users who register for an account and provide funding for an account.

23. A system according to claim 21 wherein said recipient information comprises:

- at least one shipping destination for purchases; and
- an alias attached to each shipping destination.

24. A system according to claim 15 wherein said central computer further comprises an account cross-referencing module configured to:

- retrieve user account information and account balances from a customer database;

- link the temporary card numbers received from said temporary card number module to user accounts; and
- activate the card numbers.

25. A system according to claim 24 wherein to activate the card numbers, said central computer system is configured to send instructions to activate the card numbers to the acquiring bank processor.

26. A system according to claim 24 wherein said central computer system is configured to transmit an identification output file to a user computer, the output file comprising user account information, card number information, and recipient information.

27. A system according to claim 15 wherein said central computer further comprises an omnibus accounting module configured to access a customer database to retrieve user account balances and transaction histories.

28. A system according to claim 15 wherein said central computer is configured to allow a user who is registering with the private and secure purchasing provider to select an account funding option.

29. A system according to claim 28 wherein the account funding options comprise a direct debit from a personal checking account, a charge to a credit card account, a private and secure purchasing provider online money fund, and an account at a financial institution who is partnered with the private and secure purchasing provider.

30. A system according to claim 15 wherein said central computer is configured to facilitate returns of Internet purchases.

31. A system according to claim 15 wherein said central computer is configured with a search page, which is configured to search one or more of selected Internet search engines and Internet directories to search for goods and services, based upon a single user entered search item.

32. A system according to claim 31 wherein said central computer is configured to display search results for all selected search engines and Internet directories in a single page, a frame being displayed within the page with search results for each of the selected search engines and Internet directories.

33. A system according to claim 32 whereupon selection of a hyperlink displayed within a frame, said central computer is configured to open a web browser and display a web page which corresponds to the selected hyperlink.

34. A system according to claim 15 wherein said central computer is configured with transaction histories for each user.

35. A system according to claim 15 wherein said central computer is configured with a help screen, said help screen including headings for at least one of logging in, logging off, activating checkbook, transaction history, privacy options, shopping search and returns, the headings configured as hyperlinks out of said help screen.

36. A method for operating a computer to facilitate private and secure purchasing transactions, said method comprising the steps of:

- prompting a user to enter a user ID and a password;
- prompting the user to activate a purchasing session;
- retrieving user account information; and
- generating at least one of a temporary debit card number and a temporary credit card number for use by the user in a purchasing session.

37. A method according to claim 36 further comprising the step of transmitting instructions to an acquiring bank processor to activate the card numbers.

38. A method according to claim 36 further comprising the step of prompting the user to select a recipient.

39. A method according to claim 38 further comprising the step of transmitting an identification output file to a user computer, the output file comprising at least one of user account information, card number information, and recipient information.

40. A method according to claim 39 wherein the recipient information includes an alias, the alias used to identify the recipient.

41. A method according to claim 36 further comprising the steps of:

- transmitting at least one of a temporary debit card number and a temporary credit card number to a computer of an online merchant to pay for an online purchase;

- transmitting recipient information to the merchant computer for shipping; and

- transmitting a confirmation to the merchant computer.

42. A method according to claim 41 further comprising the steps of:

- acquiring a payment authorization;

- processing the authorization as a debit card transaction if the merchant is partnered with the private and secure purchasing provider; and

- processing the authorization as a credit card transaction if the merchant is not partnered with the private and secure purchasing provider.

43. A database comprising:

- data corresponding to merchants who are partnered with a private and secure purchasing system provider;

- data corresponding to pricing for transactions;

- data corresponding to credit card and debit card numbers;

- data corresponding to users;

- data corresponding to customer histories;

- data corresponding to account balances; and

- data corresponding to user IDs and passwords.

44. A database according to claim 43 where said data corresponding to customer histories comprises data corresponding to card numbers previously assigned to a user for a purchasing session.

45. A database according to claim 43 further comprising data corresponding to recipients for a user.

46. A database according to claim 45 wherein said data corresponding to recipients further comprises an alias and shipping information for each recipient.

47. A computer programmed to:

- verify user entered member numbers and user IDs and passwords against an IDs and passwords database in a security module;

- verify user account balances;

- assign at least one temporary debit card number and at least one temporary credit card number to a user for a purchasing session;

- activate a user account for purchasing;

- connect to at least one merchant web site; and

- transmit at least one temporary card number to a merchant as payment for a purchase.

48. A computer according to claim 47, wherein to activate a user account for purchasing, said computer is programmed to transmit instructions to an acquiring bank processor to activate the card numbers.

49. A computer according to claim 47 further programmed to transmit an identification output file to a user computer, the output file comprising user account information, card number information, and recipient information.

50. A computer according to claim 49 further programmed to allow a user to select a recipient from a list of recipients within the identification output file.

51. A computer according to claim 49 wherein the recipient information includes an alias and a shipping destination for each recipient.

52. A computer according to claim 47 wherein to assign temporary card numbers, said computer is programmed to:

access a database of inactive card numbers;

select a least actively used credit card number and debit card number;

determine if the selected card numbers are currently active for any other users; and

determine if the selected numbers have been previously assigned to the user.

53. A computer according to claim 47 further programmed to receive approvals and rejections from at least one of acquiring bank processors and merchant bank card processors.

54. A computer according to claim 47 further programmed to display a search page, which is configured to allow a user to select one or more of Internet search engines and Internet directories to search for goods and services, based upon a single user entered search item into the search page.

55. A computer according to claim 54 further programmed to display search results for all selected search engines and Internet directories in a single search results page, a frame for each of the selected search engines and Internet directories being displayed within the page, the frame including the search results.

56. A computer according to claim 55 programmed to open a web browser and display a web page which corresponds to a selected hyperlink, upon selection of a hyperlink displayed within a frame.

* * * * *



US006064979A

United States Patent [19]**Perkowski**

[11] **Patent Number:** **6,064,979**
 [45] **Date of Patent:** ***May 16, 2000**

[54] **METHOD OF AND SYSTEM FOR FINDING AND SERVING CONSUMER PRODUCT RELATED INFORMATION OVER THE INTERNET USING MANUFACTURER IDENTIFICATION NUMBERS**

[75] Inventor: **Thomas J. Perkowski**, Darien, Conn.

[73] Assignee: **IPF, Inc.**, Darien, Conn.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **08/752,136**

[22] Filed: **Nov. 19, 1996**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/736,798, Oct. 25, 1996, Pat. No. 5,918,214.

[51] **Int. Cl.**⁷ **G06F 17/60**

[52] **U.S. Cl.** **705/26; 235/375; 378/93.12; 709/219; 705/27**

[58] **Field of Search** **705/1, 14, 16, 705/21, 22, 24, 26, 27; 707/1, 2, 3, 4, 10, 101, 104, 501, 513; 395/200.3, 200.31, 200.33, 200.47, 200.48, 200.49; 235/375, 376, 462; 329/93.12, 709/219**

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 WO 98/06055 2/1998 WIPO G06F 63/00
 WO 98/09243 3/1998 WIPO G06F 19/00
 WO 98/20411 5/1998 WIPO G06F 3/00

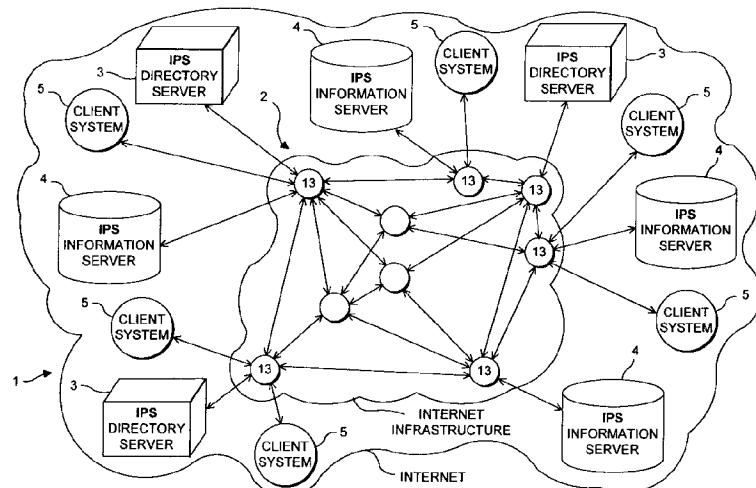
Primary Examiner—Stephens R. Tkacs

Attorney, Agent, or Firm—Thomas J. Perkowski, Esq., P.C.

ABSTRACT

A method of and system for finding and serving consumer product-related information on the Internet comprising a database serving subsystem which stores: a plurality of manufacturer identification numbers (MINs) assigned to a plurality of manufacturers of consumer products; a plurality of home-page specifying URLs symbolically linked to the plurality of MINs; a plurality of universal product numbers (UPN) assigned to a plurality of consumer products made by the plurality of manufacturers; and a plurality of product-information specifying URLs symbolically linked to the plurality of UPNs. During operation, a client subsystem transmits to the database serving subsystem, a request for information which includes the UPN assigned to the consumer product on which product-related information is being sought. The database serving subsystem automatically compares the UPN against the stored plurality of MINs, and automatically returns to the client subsystem, one or more of URLs symbolically linked to the UPN, if URLs have been symbolically linked to the UPN within the database serving subsystem. However, if no URLs have been symbolically linked to the UPN, then the database serving subsystem automatically returns the home-page specifying URL symbolically linked to the MIN contained within the UPN in the request. By virtue of this novel MIN-based search mechanism embodied within the database serving subsystem, client subsystems are automatically provided with the home-page of the manufacturer's World Wide Web (WWW) site in situations where product-information specifying URLs have not yet been symbolically linked with the UPN on any one of the manufacturer's products.

27 Claims, 12 Drawing Sheets



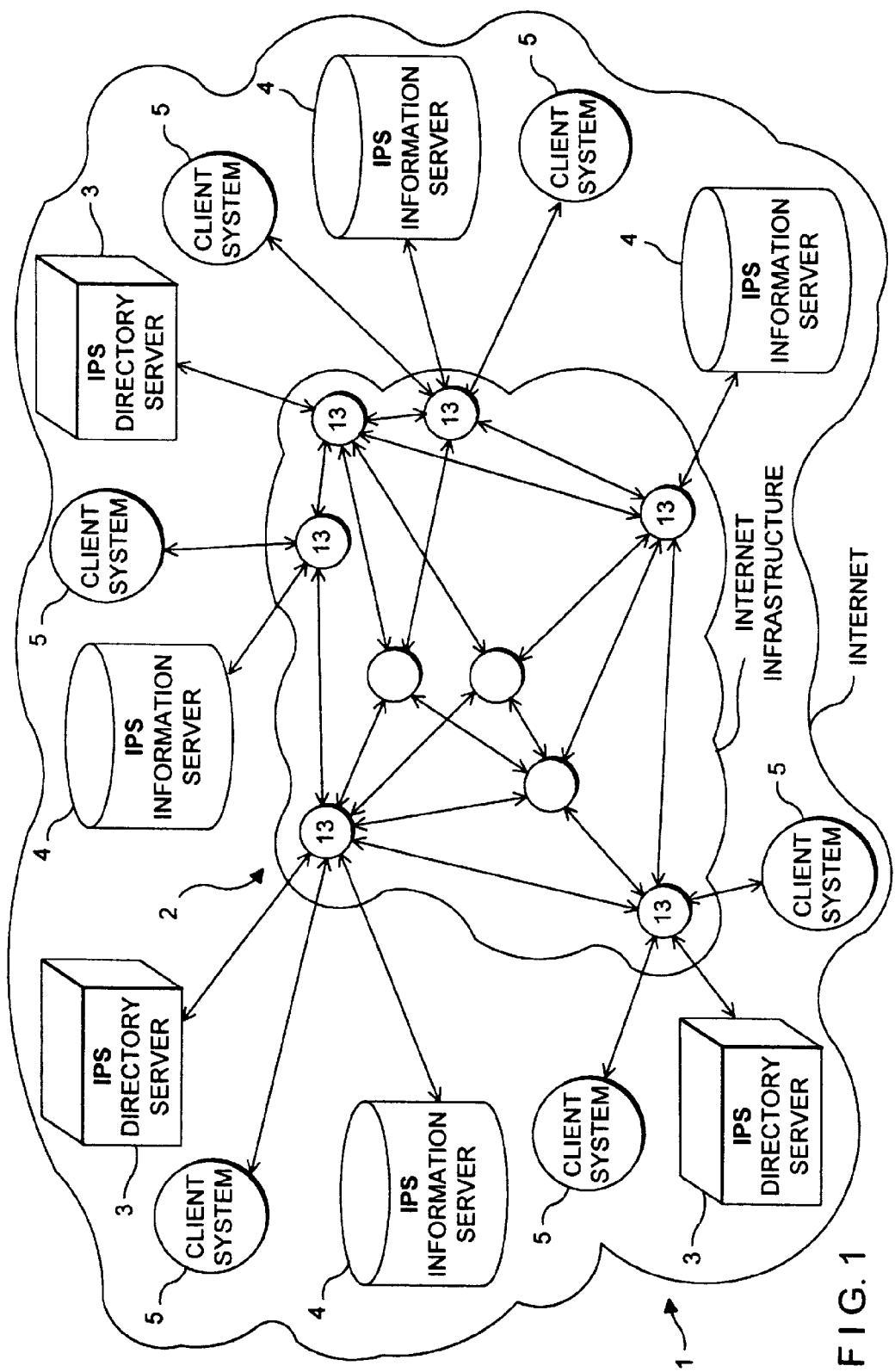


FIG. 1

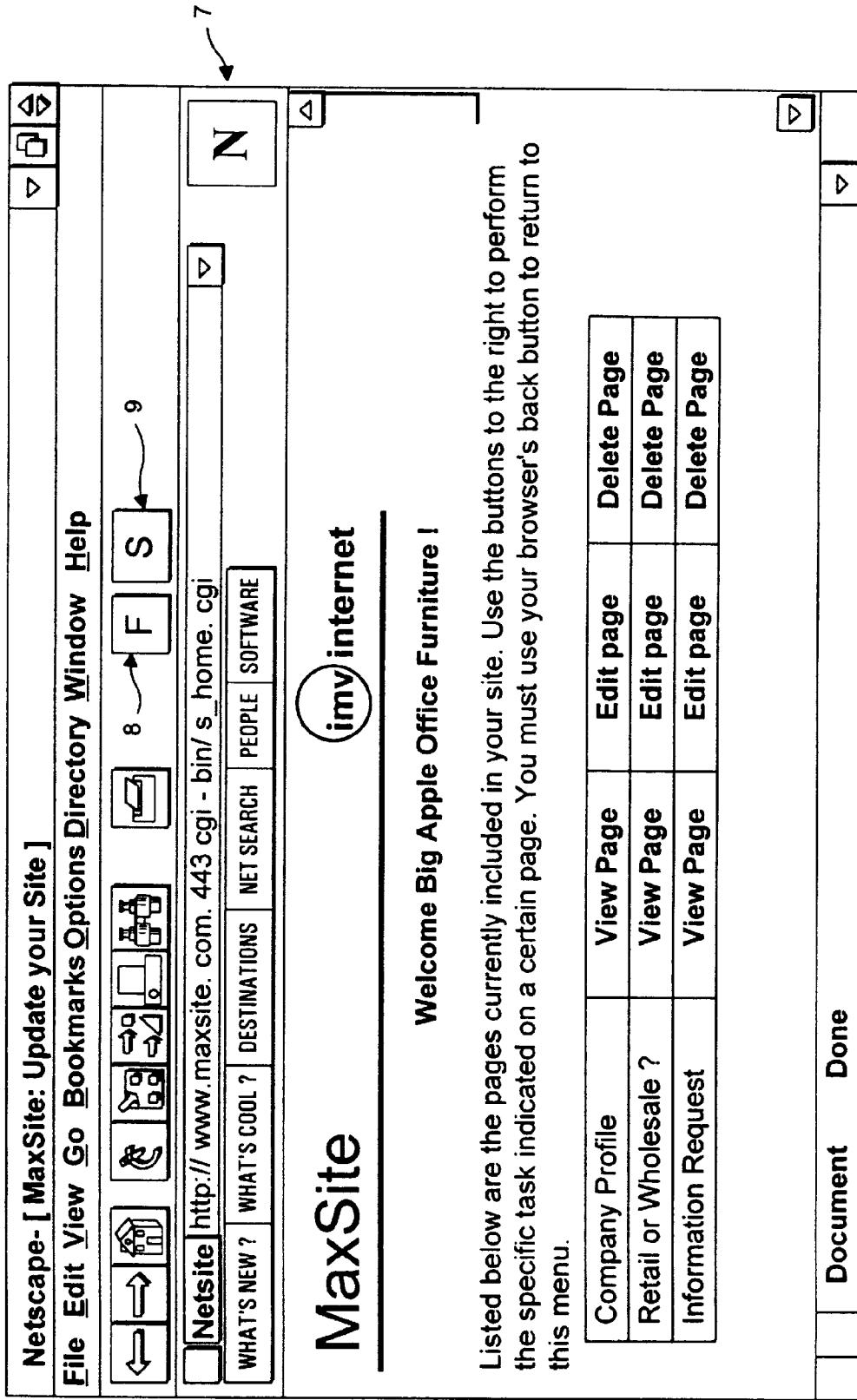


FIG. 1A

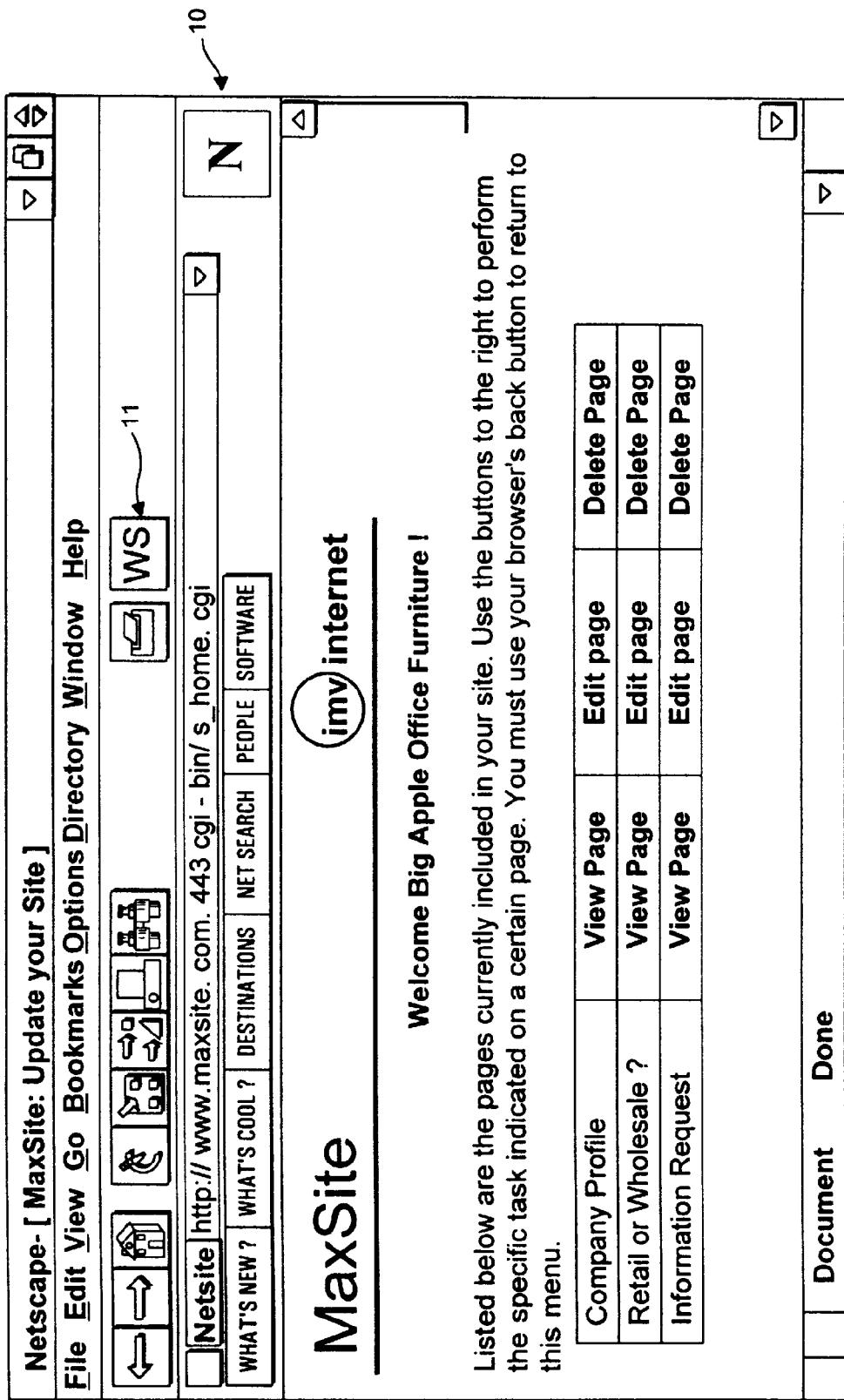


FIG. 1B

IP / S/N	REGISTRANTS NAME	PRODUCT DESCRIPTION	UNIFORM RESOURCE LOCATOR (URL)	TRADE/ SERVICE MARKS	e-mail Address	Status
7/18908/17674/0	APPLE COMPUTER, INC. CUPERTINO, CALIF.	POWER MAC. 7600/120 PERSONAL COMPUTER	http://www.power.pc	POWER MAC.		
0/373/100/6	PROCTOR & GAMBLE	TOOTH PASTE	http://www.tooth.p.pc	CREST		
3/12547/68404/0	WARNER WELCOME	ACID REDUCER	http://www.zantac.pc	ZANTAC, ZANTAC 75		
0/00005/17643/4	KODAK, INC.	FILM PROCESSING	http://www.kodak.pc	KODAK		
...
0/27242/51057/9	SONY, INC.	PERSONAL COMPUTER	http://www.sony.com.pc	SONY		

FIG. 2A1

F | G. 2A2

IP / S/N	REGISTRANT'S NAME	PRODUCT DESCRIPTION	TRADE/SERVICE MARKS	E-MAIL ADDRESS	STATUS
7/05089/374607	NETSCAPE COMMUNICATIONS CORP.	INTERNET NAVIGATOR	NETSCAPE, NAVIGATOR		
0/30000/01020/4	QUAKER, INC.	OATMEAL	QUAKER		
0/496/390/1	COLA COLA, INC.	COLA SODA	COCA - COLA, COKE		
0/7599/24245/2	WARNER BROS.	PAT METHANY AUDIO CD	GEFFEN		
				:	...
				:	...

FIG. 2B

"IPSI FINDER MODE"

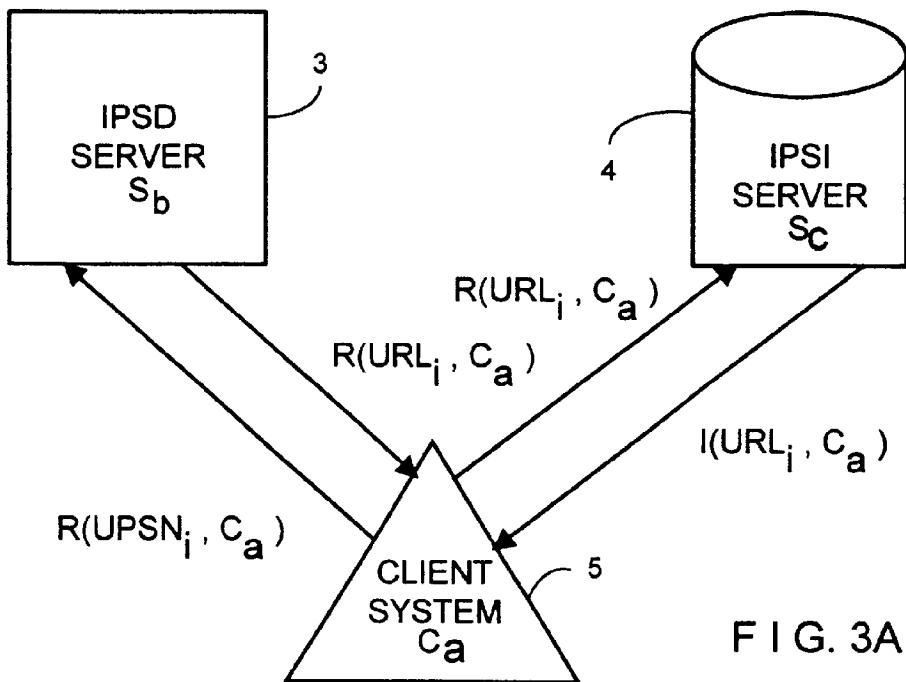


FIG. 3A

"UPSN SEARCH MODE"

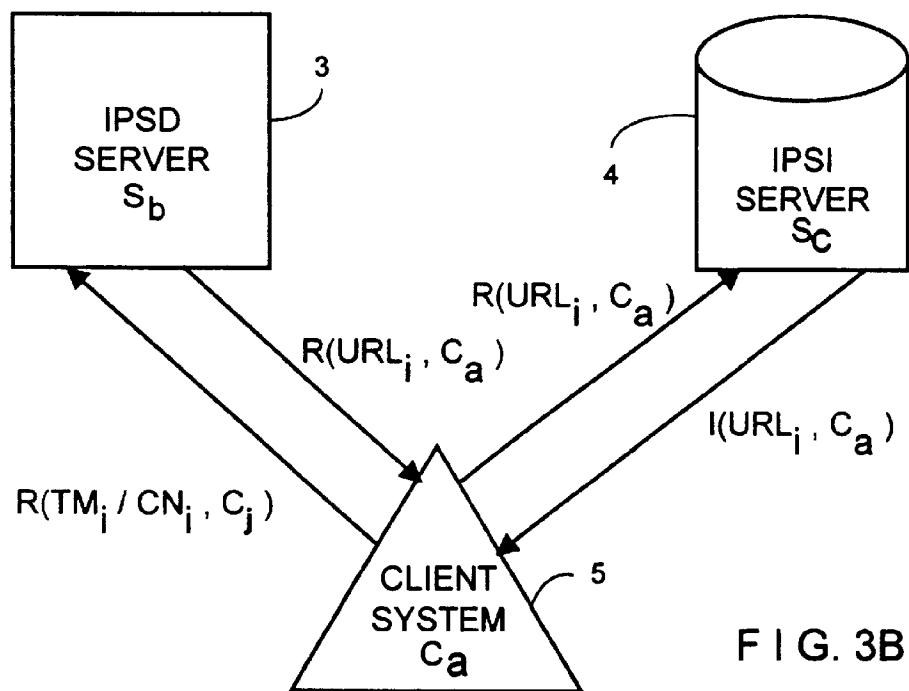
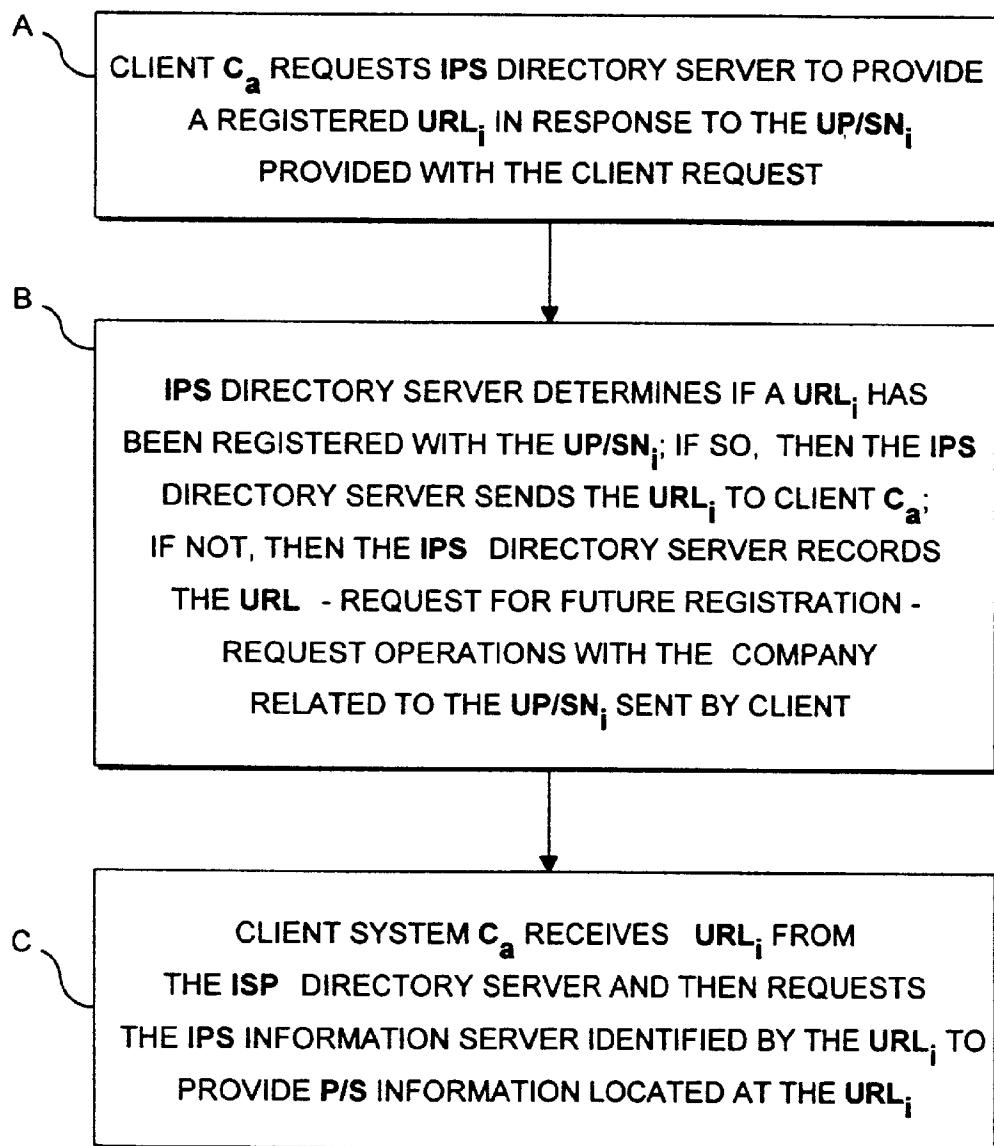
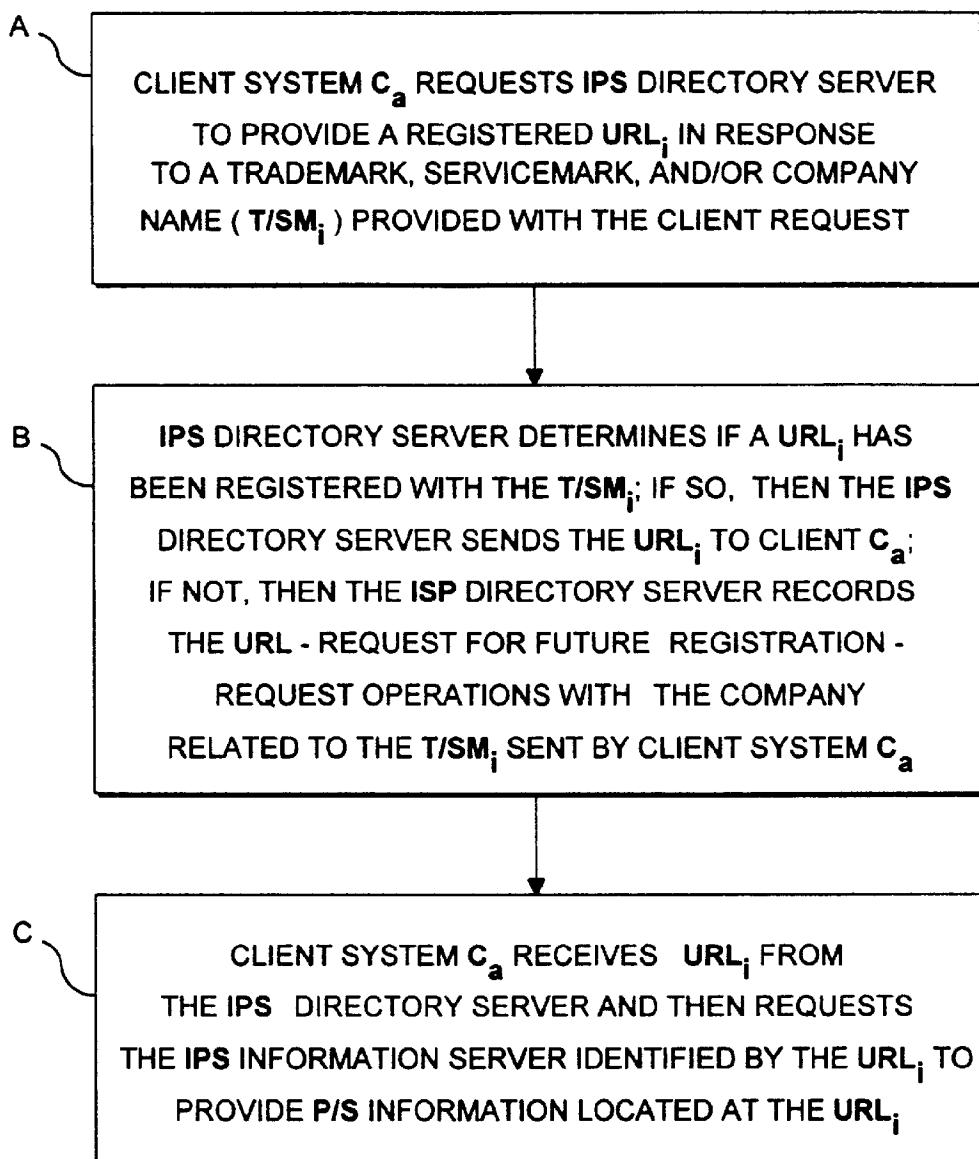


FIG. 3B



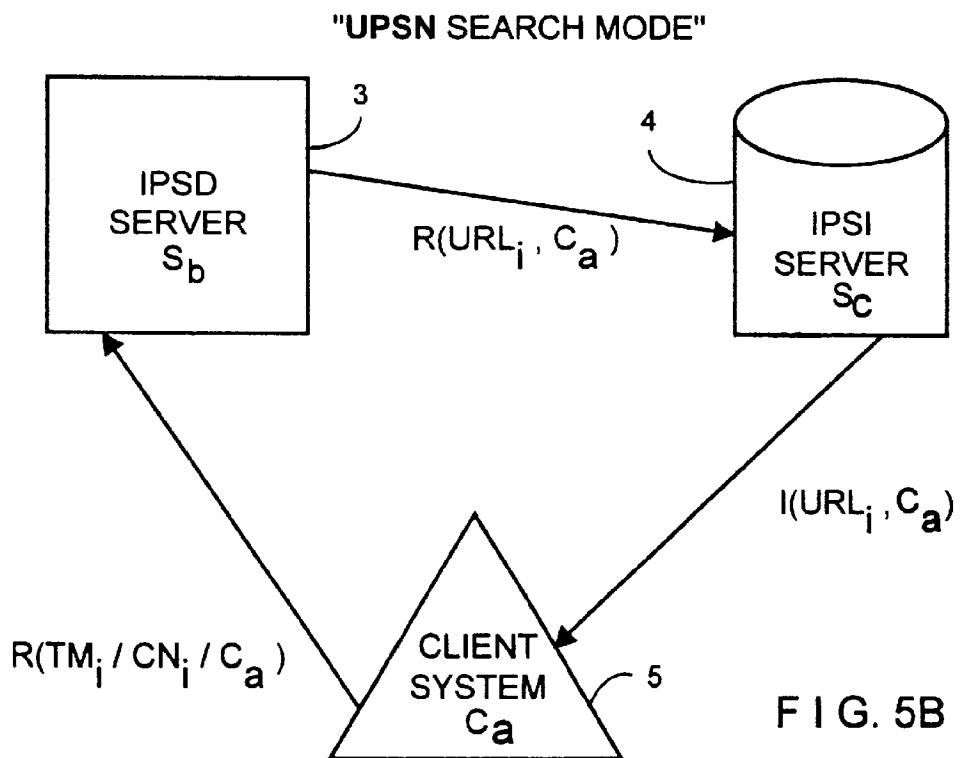
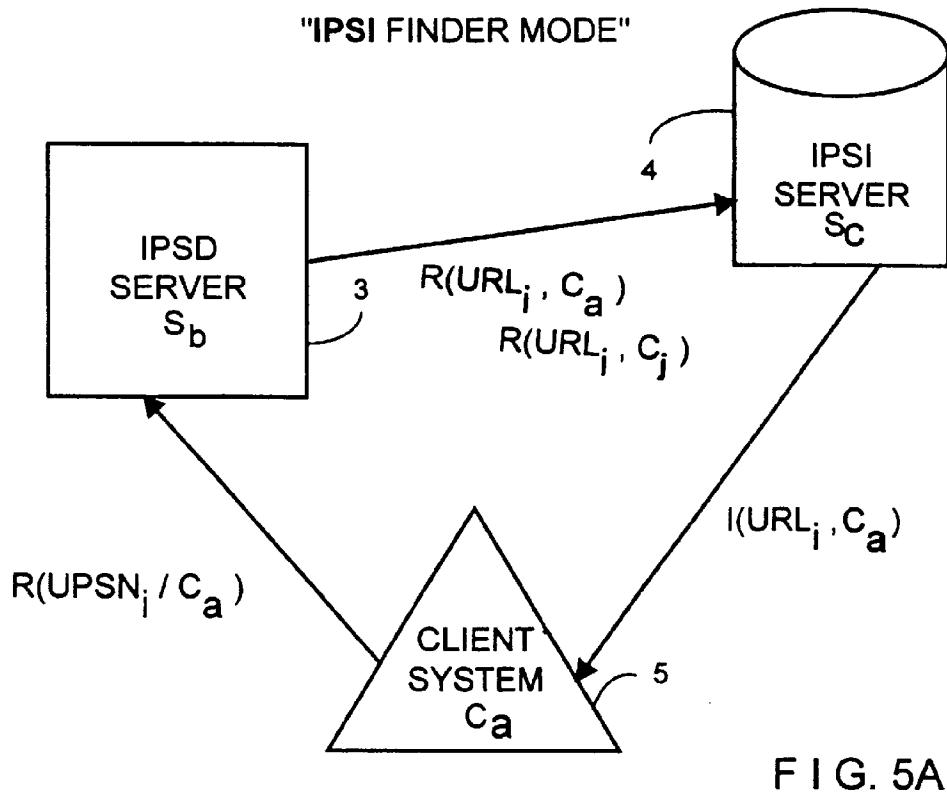
"IPSI FINDER MODE (FIG. 3A)"

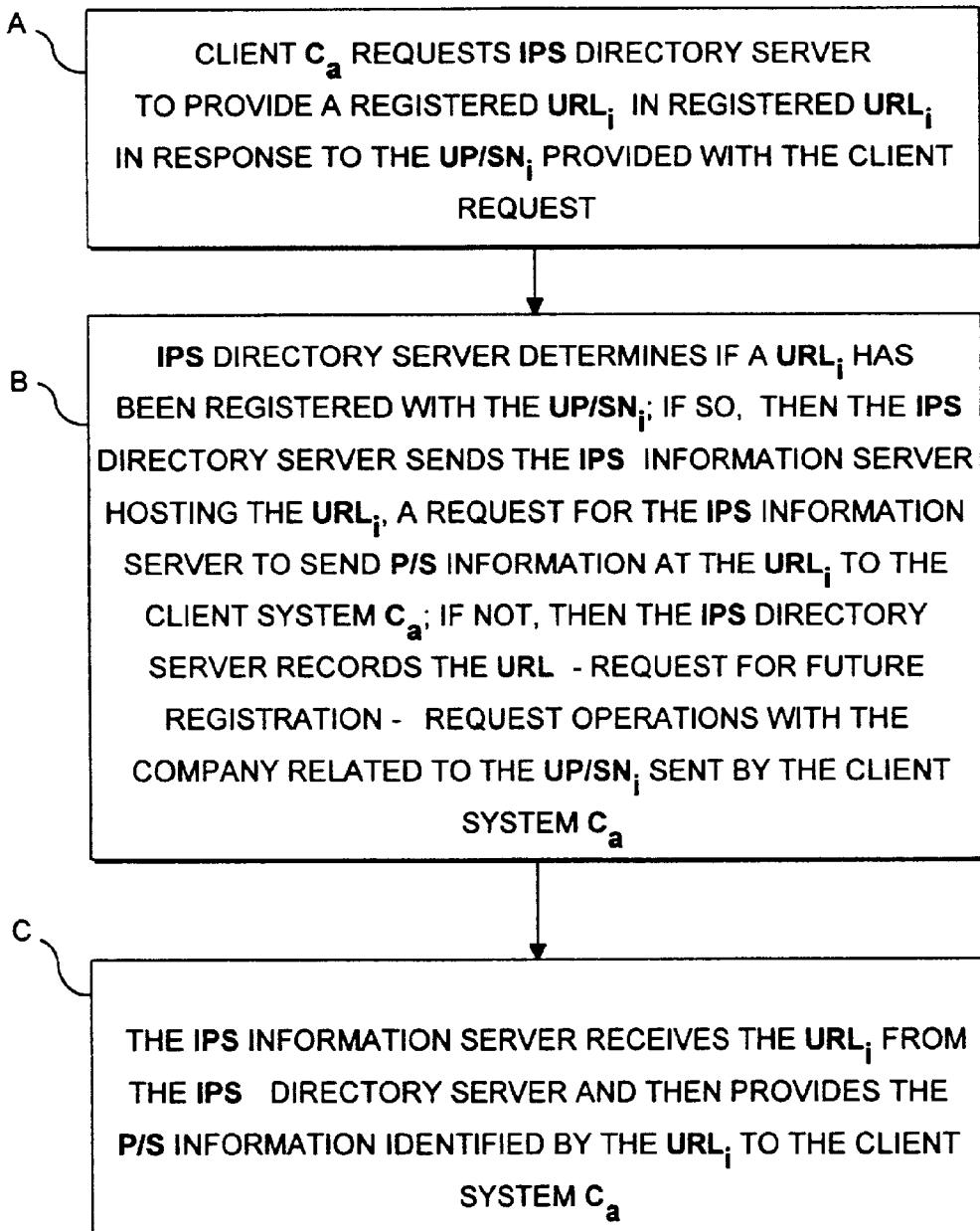
FIG. 4A



"UP/SN SEARCH MODE (FIG. 3B)"

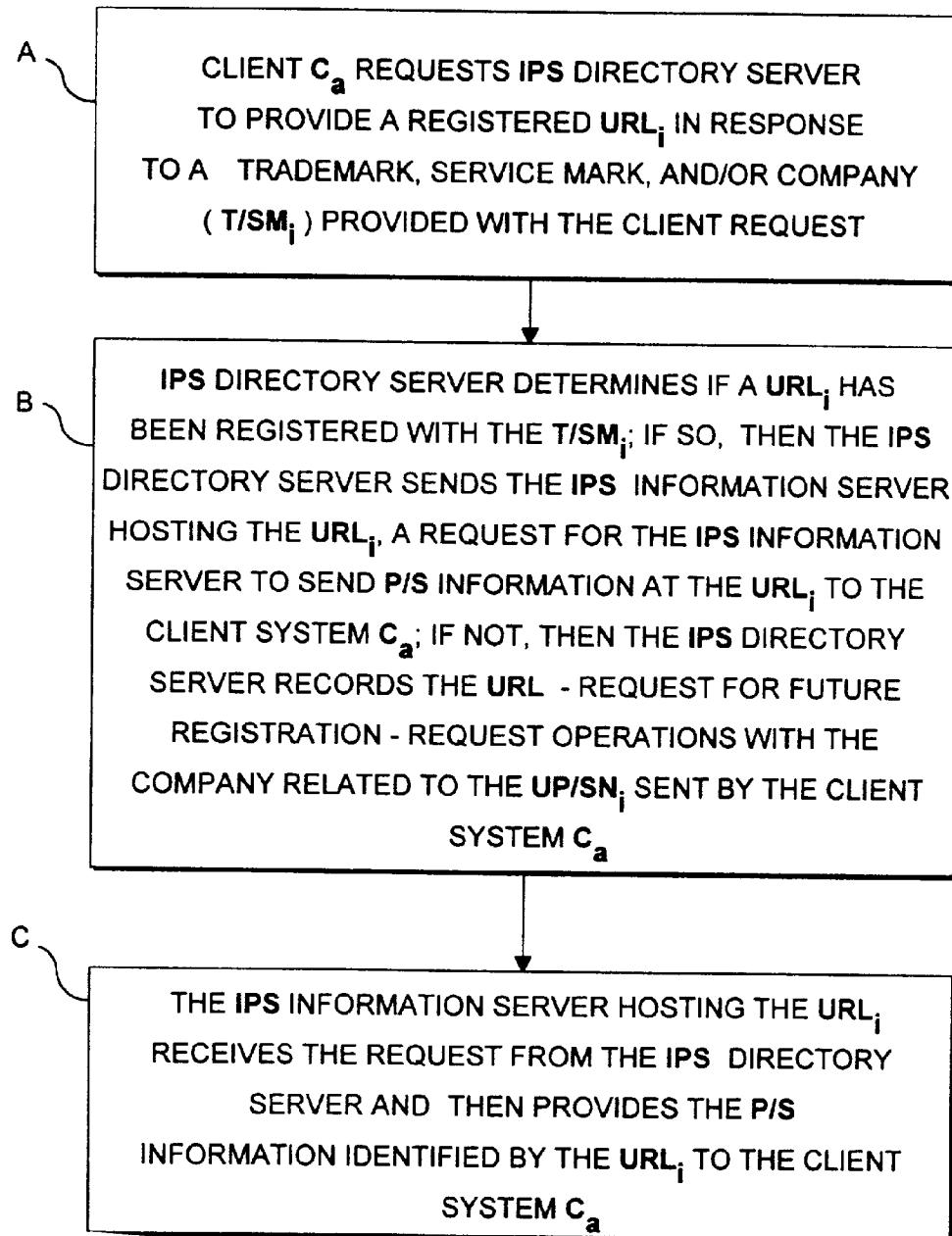
FIG. 4B





"IPSI FINDER MODE (FIG. 5A)"

F I G. 6A



"UP/SN SEARCH MODE (FIG. 5B)"

FIG. 6B

**METHOD OF AND SYSTEM FOR FINDING
AND SERVING CONSUMER PRODUCT
RELATED INFORMATION OVER THE
INTERNET USING MANUFACTURER
IDENTIFICATION NUMBERS**

RELATED CASES

This is a Continuation-in-Part of application Ser. No. 08/736,798 entitled "System And Method For Finding Product And Service Related Information On The Internet" filed by Thomas J. Perkowski on Oct. 25, 1996, now U.S. Pat. No. 5,918,214, and incorporated herein by reference in its entirety.

BACKGROUND OF INVENTION

1. Field of Invention

The present invention relates to a system and method for finding product and service related information on the International Information Infrastructure (e.g. the Internet).

2. Brief Description of the Prior Art

Presently, an enormous amount of time, money and effort is being expended by companies in order to advertise and sell their products and services, and post-purchase product-related information, warranty service and the like. For decades, various types of media have been used to realize such fundamental business functions.

In recent times, there has been a number of significant developments in connection with the global information network called the "Internet", which has greatly influenced many companies to create multi-media Internet Web-sites in order to advertise, sell and maintain their products and services. Examples of such developments include, for example: the Hypertext Markup Language (HTML) based World Wide Web (WWW) by Tim Berners-Lee; user friendly GUI-based Internet navigation tools, such as the Netscape® browser from Netscape Communications, Inc., the Internet Explorer™ browser from MicroSoft Corporation and the Mosaic™ browser from Spyglass Corporation; and the Virtual Reality Modelling Language (VRML) by Mark Pecse. Such recent developments have made it very easy for businesses to create 2-D Hypermedia-based Home Pages and 3-D VR Worlds (i.e. 3-D Web-sites) for the purpose of projecting a desired "corporate image" and providing a backdrop for financial investment solicitation, product and service advertisement, sales and maintenance operations.

Presently, a person desiring to acquire information about any particular product has numerous of available search options. In particular, he or she may attempt to directly contact the manufacturer, wholesaler or reseller via telephone, US mail, e-mail, or the company's World Wide Web-site (WWW), if such a one exists. In order to acquire product information through the seller's WWW site, the inquirer must first determine the location of its WWW site (i.e. Internet address) which oftentimes can involve using Internet Search engines such as Yahoo®, AltaVista™, WebCrawler™, Lycos™, Excite™, or the like. This can be a very time consuming process and may lead to a dead end. Upon obtaining the Internet address one must then review the home page of the company's Web-site in order to find where, if at all, information about a particular product resides on the Website. This search process can be time consuming and therefore expensive (in terms of Internet time) and may not locate the desired information on the product of interest.

In some instances, product brochures bear a preprinted Internet address designed to direct or point prospective customers to a particular Web-site where more detailed product information can be found. A recent example of this "preprinted Web Address" pointing technique is the 1996 product brochure published by the Sony Corporation for its Sony® PCV-70 Personal Computer, which refers prospective customers to the Sony Web Address "http://www.sony.com/pc". While this approach provides a direct way of finding product and service related information on the Internet, it is not without its shortcomings and drawbacks.

In particular, when a company improves, changes or modifies an existing Web-site which publishes product and/or service advertisements and related information, it is difficult (if not impossible) not to change the Internet locations (i.e. Web addresses) at which such product and/or service advertisements and related information appear. Whenever a company decides or is forced to change any of its advertising, marketing and/or public relations firms, there is a substantial likelihood that new Web-sites will be created and launched for particular products and services, and that the Web addresses of such new Web-sites will no longer correspond with the Web addresses on preprinted product and service brochures in currently in circulation. This can result in pointing a consumer to erroneous or vacant Web-sites, which present either old or otherwise outdated product and/or service information, and thereby possibly adversely influencing the consumer's purchasing decision.

Moreover, when a company launches a new Web-site as part of a new advertising and marketing campaign for a particular product or service, any preprinted advertising or marketing material relating to such products and services will not reflect the new Web-site addresses which the campaign is promoting for consumer visitation. This fact about preprinted advertising media renders it difficult to unify new and old advertising media currently in circulation into thematically coherent advertising and marketing campaign. In short, the inherently static nature of the "preprinted Web address" pointing technique described above is wholly incapable of adjusting to the dynamic needs of advertising, marketing and public relations firms alike.

In addition to the above-described techniques, I-World by Mecklermedia has recently launched a commercial product finder database on the Internet called "Internet Shopper". Notably, the "Internet Shopper" database is organized by specific types of product categories covering computer and telecommunication related technologies. While this product information finding service may be helpful to potential consumers of computer or communication equipment, nevertheless it fails to provide an easy way to find information on previously purchased products, or on products outside of the field of communication or computer technology. Consequently, the value of this prior art technique is limited to those considering the purchase of products catalogued within the taxonomy of the "Internet Shopper" directory.

In view of the inherent limitations of I-World's "Internet Shopper" and other product finding directories on the Internet, such as "NetBuyer" by Computer Shopper (at "http://www.netbuyer.com"), the National Information Infrastructure Testbed (NIIT) organization has recently formed a "confidential committee of NIIT members" under the title "Universal Product and Service Code Project". The stated problem addressed by this Project is to determine how to locate specific goods and services on the Internet, and how to compare prices and other critical market information. As publicized in a NIIT Project Abstract, the "Universal

Product and Service Code Project seeks to make it easier to electronically locate goods and services on the Internet using universal product and service identifiers and locators. As stated in the Project Abstract, the "NIIT believes that changing the way in which Internet information is organized is fundamental to solving this problem. In the Universal Product and Service Code Project, NIIT members are currently exploring how coding structures can help organize information about products and services accessible using the Internet. NIIT's goal is to inform the development of formalized coding standards that can be used nationally and internationally so that users can locate goods and services through simple searching and browsing methods. In turn, more advanced features, such as comparison shopping, can be added as "intelligent agent" software programs are refined to enable users to search and retrieve products and services linked to these structures.

While the NIIT's Universal Product and Service Code Project seeks ways of locating specific goods and services on the Internet, all proposals therefor recommend the development of formalized coding standards and searching and browsing methods which are expensive and difficult to develop and implement on a world-wide basis. Moreover, such sought after methods will be virtually useless to consumers who have already purchased products and/or services and now seek product and/or service related information on the Internet.

Thus, it is clear that there is great need in the art for a system and method for finding commercial product and service information on the Internet, in a way which avoids the shortcomings and drawbacks of prior art systems, proposals, and methodologies.

OBJECTS AND SUMMARY OF INVENTION

Accordingly, a primary object of the present invention is to provide a novel system and method for finding product and service related information on the Internet, while avoiding the shortcomings and drawbacks of prior art systems and methodologies.

Another object of the present invention is to provide such a system and method, which will accelerate the acceptance of the electronic marketplace on the Internet, particularly by consumers and small businesses alike.

Another object of the present invention is to provide such a system and method, wherein virtually any type of product or service can be registered with the system by symbolically linking or relating (i) its preassigned Universal Product or Service Number (e.g. UPC number) or at least the Manufacturer Identification Number (MIN) portion thereof with (ii) the Uniform Resource Locators (URLs) of one or more information resources on the Internet (e.g. the home page of the manufacturer's Web-site) related to such products or services.

Another object of the present invention is to provide such a system and method with an improved Internet browser or Internet application tool having both an "Internet Product/Service Information (IPSI) Finder" button for entering the "IPSI Finder Mode" of the system when it is selected, and also a "Universal Product/Service Number (UPSN) Search" button for entering the "UPSN Search Mode" when the "UPSN Search" button is selected.

Another object of the present invention is to provide such a system, wherein when the system is in its IPSI Finder Mode, a predesignated information resource (e.g. advertisement, product information, etc.) pertaining to any commercial product or service registered with the system

can be automatically accessed from the Internet and displayed from the Internet browser by simply entering the registered product's UPN or the registered service's USN into the Internet browser.

Another object of the present invention is to provide such a system, wherein during the "UPSN Search Mode" of the system, a predesignated information resource (e.g. advertisement, product information, etc.) pertaining to any commercial product or service registered with the system can be automatically accessed from the Internet and displayed from the Internet browser by simply entering the registered product's trademark(s) and/or associated company name into the Internet browser.

Another object of the present invention is to provide such a system, wherein a predesignated information resource pertaining to any commercial product or service having been assigned a Universal Product Number (UPN) or Universal Service Number (USN) can be accessed from the Internet and displayed from the Internet browser by simply selecting its IPSI Finder button and then entering the UPN or USN numeric string into a dialogue box which pops up on the display screen of the Internet browser program.

Another object of the present invention is to provide such a system in which a relational database, referred to as "an Internet Product and Service Directory (IPSD)," is realized on one or more data-synchronized PSD Servers for the purpose of registering product and service related information, namely: (i) information representative of commercial product descriptions, the trademarks used in connection therewith, the company names providing and/or promoting such products, the e-mail addresses of such companies, and the corresponding URLs on the Internet specifying current (i.e. up-to-date) Internet Web-site locations providing product-related information customized to such products; and (ii) information representative of commercial service descriptions, the servicemarks used in connection therewith, the company names providing and/or promoting such services, the E-mail addresses of such companies, and the corresponding URLs on the Internet specifying current (i.e. up-to-date) Internet Web-site locations providing service-related information customized to such services.

Another object of the present invention is to provide such a product information finding system, wherein the URLs symbolically linked to each registered product in the PSD Servers thereof are categorized as primarily relating to Product Advertisements, Product Specifications, Product Updates, Product Distributors, Product Warranty/Servicing, and/or Product Incentives (e.g. rebates, discounts and/or coupons), and that such URL categories are graphically displayed to the requester by way of easy-to-read display screens during URL selection and Web-site connection.

Another object of the present invention is to provide a novel method of carrying out electronic-type commercial transactions involving the purchase of products and services which are advertised on the Internet at uniform resource locations (URLs) registered with the IPSI system of the present invention.

Another object of the present invention is to provide a novel system and method of finding the UPN or USN associated with any particular registered product or service, respectively, by simply selecting a GUI button on the Internet browser display screen in order to enter a "UPSN Search Mode", whereby (i) a dialogue box is displayed on the display screen requesting any known trademarks associated with the product, and/or the name of the company that

makes, sells or distributes the particular product, and (ii) the corresponding UPN (i.e., UPC number or EPC number) registered with the IPSD Servers is displayed to the user for acceptance, whereupon the Internet information resource locators (URLs) are automatically accessed from the IPSD Servers and displayed on the display screen of the Internet browser for subsequent URL selection and Web-site connection.

Another object of the present invention is to provide such a system and method, wherein during the UPSN Search Mode, the UPN (e.g. UPC number) associated with any registered product can be found within the database of the IPSD Server using any trademark(s) and/or the company name commonly associated with the product, and the USN number associated with any registered service can be found within the database of the IPSD Server using any servicemark(s) and/or the company name commonly associated with the service.

Another object of the present invention is to provide such a system and method in the form of an electronic kiosk installed within a store and having an automatic projection-type, laser scanning bar code symbol reader for reading the UPC numbers on products being offered for sale in the store, and also a video display screen for displaying product-related information accessed from hyper-linked Web-sites on the Internet.

Another object of the present invention is to provide a novel method of constructing a relational database for use within the product and service information finding system of the present invention.

Another method of the present invention is to provide such a method of database construction, wherein the relational database is initially "seeded" with (i) the six digit UPC Manufacturer Identification Numbers (MIN) incorporated into the first six characters of each UPC number applied to the products thereof and (ii) the URLs of the Web-site home pages of such manufacturers, and is subsequently extended and refined with the participation of each registered manufacturer (and/or product distributor) by adding to the database (iii) the 12 digit UPC numbers assigned to each product sold thereby and (iv) the URLs symbolically linked to each such corresponding product.

Another object of the present invention is to provide such a system and method, in which Web-site-based advertising campaigns can be changed, modified and/or transformed in virtually any way imaginable by simply restructuring the symbolic links between the products and/or services in the campaign using current (i.e. up-to-date) Web-site addresses at which Web-site advertisements and information sources related thereto are located on the Internet.

Another object of the present invention is to provide a novel system and method of automatically soliciting companies to register their products and services within the databases of such IPSD Servers in order that product and service related information of a multimedia nature (e.g. Web-sites), once registered therewith, can be easily found on the Internet by any potential consumer using the system and method of the present invention.

These and other objects of the present invention will become apparent hereinafter and in the claims to Invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of how to practice the Objects of the Present Invention, the following Detailed Description of the Illustrative Embodiments should be read in conjunction with the accompanying Drawings, wherein:

FIG. 1 is a schematic diagram of a first illustrative embodiment of the product and service information finding system of the present invention shown embedded with the infrastructure of the global computer communications network known as the "Internet", and comprising a plurality of data-synchronized Internet Product and Service Directory (IPSD) Servers connected to the infrastructure of the Internet, a plurality of Internet Product and Service Information (IPSI) Servers connected to the infrastructure of the Internet, and a plurality of Client Systems connected to the infrastructure of the Internet;

FIG. 1A is a schematic representation of an exemplary display screen produced by a graphical user interface (GUI) based web browser program running on a Client System and providing an on-screen IPSI Finder button and an on-screen UPSN Search button for carrying out the IPSI finding method of the present invention;

FIG. 1B is a schematic representation of an exemplary display screen produced by a GUI-based web browser program running on a Client System and providing an on-screen IPSD Web-site Finder button for instantly connecting to the IPSD Web-site and carrying out the Internet Product and Service Information finding method of the present invention;

FIG. 2A1 is a schematic representation of the relational-type IPSI Registrant Database maintained by each IPSD Server that is configured into the IPSI finding system of the illustrative embodiment of the present invention, showing the information fields for storing (i) the information elements representative of the UPN (e.g. UPC numeric data structure, National Drug Code (NDC) numeric data structure, and/or European Product Code (EPC) alphanumeric data structure), URLs, trademark(s) (TM_i), Company Name (CN_i), Product Description (PD_i) and E-mail Address (EMA_i) thereof symbolically-linked (i.e. related) for a number of exemplary IPSI Registrants listed (i.e. registered) with the IPSI Registrant Database maintained by each IPSD Server, and (ii) the information elements representative of the UPN (e.g. UPC numeric data structure, National Drug Code (NDC) numeric data structure, and/or European Product Code (EPC) alphanumeric data structure), URLs, servicemark(s) (SM_i), Company Name (CN_i), Service Description (SD_i) and E-mail Address (EMA_i) thereof symbolically-linked for a number of exemplary IPSI Registrants registered with the IPSI Registrant Database maintained by each IPSD Server;

FIG. 2A2 is a schematic representation of the information subfield structure of the URL Information Field of the IPSD Database of FIG. 2A1, showing the Product Advertisement Information Field, the Product Specification (Description) Information Field, the Product Update Information Field, the Product Distributor Information Field, the Product Warranty/Servicing Information Field, the Product Incentive Information Field thereof, the Product Review Information Field, and Miscellaneous Information Field;

FIG. 2B is a schematic representation of the relational-type Non-IPSI Registrant Database maintained by each IPSD Server that is configured into the IPSI finding system of the illustrative embodiment of the present invention, showing the information fields for storing (i) the information elements representative of the Company Name (CN_i), Trademark(s) (TM_i) registered by the associated Company, and E-Mail Address (EMA_i) thereof symbolically-linked for a number of exemplary Non-IPSI registrants listed within the Non-IPSI Registrant Database maintained by each IPSD Server, and (ii) the information elements representative of

the Company Name (CN_i), Servicemark(s) (SM_i) registered by the associated Company, and E-Mail Address (EMA_i) thereof symbolically-linked for a number of exemplary Non-IPSI registrants listed within the Non-IPSI Registrant Database maintained by each IPSD Server;

FIG. 3A is a schematic diagram illustrating the high level structure of a first type of communication protocol that can be used among the Client System C_a, the IPSD Server S_b, and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program running on the Client System is in its IPSI Finder Mode of operation, requesting as input a UPSN (i.e. UPN or USN data structure) to determine the URL(s) of the corresponding product (or service) registered therewith;

FIG. 3B is a schematic diagram illustrating the high level structure of a first type of communication protocol that can be used among the Client System C_a, the IPSD Server S_b, and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its UPSN Search Mode of operation, requesting as input a trademark (or servicemark) and/or company name in order to determine the UPSN (i.e. UPN or USN data structure) of the corresponding product (or service) and thus the URL(s) registered therewith;

FIG. 4A is a high level flow chart illustrating the steps involved in carrying out the communication protocol shown in FIG. 3A when the Client System is in its IPSI Finder Mode of operation;

FIG. 4B is a high level flow chart illustrating the steps involved in carrying out the communication protocol shown in FIG. 3A when the Client System is in its UPSN Search mode of operation;

FIG. 5A is a schematic diagram illustrating the high level structure of a second type of communication protocol that can be used among the Client System C_a, the IPSD Server S_b, and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its IPSI Finder Mode of operation, requiring as input a UPSN to determine the URL(s) of the corresponding product (or service) registered therewith;

FIG. 5B is a schematic diagram illustrating the high level structure of a second type of communication protocol that can be used among the Client System C_a, the IPSD Server S_b, and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its UPSN Search Mode of operation, requiring as input a trademark (or servicemark) and/or company name in order to determine the UPSN of the corresponding product (or service) and thus the URL(s) registered therewith;

FIG. 6A is a high level flow chart illustrating the steps involved in carrying out the communication protocol shown in FIG. 5A when the Client System is in its IPSI Finder Mode of operation; and

FIG. 6B is a high level flow chart illustrating the steps involved in carrying out the communication protocol shown in FIG. 5A when the Client System is in its UPSN Search mode of operation.

Overview Of The Internet Product And Service Information (IPSI) Finding System Hereof

As shown in FIG. 1, the product/service information finding system of the present invention is generally indicated by reference numeral 1 and comprises an arrangement of system components, namely: a globally-based digital telecommunications network (such as the Internet) 2 having an infrastructure (including Internet Service Providers (ISPs), Network Service Providers (NSPs), routers, telecommunication lines, channels, etc.) for supporting packet-switched type digital data telecommunications using the TCP/IP networking protocol well known in the art; one or more Internet Product and Service Directory (IPSD) Servers, each indicated by reference numeral 3 and being connected to the Internet at strategically different locations via the Internet infrastructure and data-synchronized with each other in order that each such Server maintains mirrored a database structure as represented in FIGS. 2A1 through 2B; a plurality of Internet Product and Service Information (IPSI) Servers, each indicated by reference numeral 4 and being connected to the Internet via the Internet infrastructure; and a plurality of User (or Client) Computers, each indicated by reference numeral 5 and being connected to the Internet via the Internet infrastructure.

In a first illustrative embodiment of the system shown in FIG. 1, each Client Computer 5 has an GUI-based Internet browser program (e.g. Netscape, Internet Explorer, Mosaic, etc.) which has been provided with a suitable plug-in type module constructed in such as way to provide the functionalities of the present invention. An exemplary display screen produced by the GUI-based web browser program is set forth in FIG. 1A. As shown, the GUI-based web browser program provides an onscreen IPSI Finder Button 8 and an on-screen US/PN Search Button 9 for carrying out the IPSI finding method of the present invention. The details of these functions will be described hereinafter.

In an alternative embodiment of the system shown in FIG. 1, each Client Computer has a conventional GUI-based web browser program (e.g. Netscape, Internet Explorer, Mosaic, etc.) with a plug-in type module, such as CyberFinder™ navigational software by Aladdin Systems, Inc., of Watsonville, Calif., that provides an on-screen graphical icon for a "IPSI Web-site Finder" function. An exemplary display screen 10 produced by such a GUI-based web browser program is set forth in FIG. 1B. As shown, the on-screen IPSI Web-site Finder icon functions as an "IPSI Web-site Finder" Button 11 for instantly connecting the Client System to the IPSI Web-site (i.e., on each IPSD Server) and carrying out the Internet Product and Service Information (IPSI) finding method of the present invention. Upon selecting this button (e.g. by a clicking of the mouse), the user is automatically connected to the IPSI Web-site (supported on each IPSD Server), at whose "home page" appears the IPSI Finder and UPSN Search buttons described above appear and functionalities represented thereby. The URL for the home page of the IPSI Web-site should be selected with marketing considerations in mind, for example, "http://www.ipf.com" or "http://www.ipsi.com" similar in form with the URLs of other information search-engines and directories currently available on the Internet. Alternatively, the URL of the home page of the PSI Web-site can be recorded as a browser "bookmark" for easy recall and access through a conventional GUI-based Internet browser. Once at the home page of the IPSI Web-site, an Internet user can find product and service related information on the Internet in essentially the same way as when using the web browser program of FIG. 1A.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS OF THE PRESENT INVENTION

Referring to the figures shown in the accompanying Drawings, like structures and elements shown throughout the figures thereof shall be indicated with like reference numerals.

In the illustrative embodiment, each synchronized IPSD Server **3** can be realized by, for example, the PowerMac® Internet Server from Apple Computer, Inc. or any other suitable computing machine that can perform the function of a Server in a web-based, client-server type computer system architecture of the illustrative embodiment. As shown in FIG. 1, each IPSD Server is interfaced with an ISP **13** in a conventional manner. The actual number of IPSD Servers used in any particular application will depend on various factors including, for example, user demand, Internet traffic conditions, network router capacity and performance, etc. Each such IPSD Server is assigned a static TCP/IP address and a unique domain name on the Internet. Each IPSD Server is also provided with (i) Internet networking software to support the TCP/IP networking protocol, (ii) an Application Programming Interface (API) for Web-site and application program development and (iii) Web-site server software for creating and maintaining the IPSI Registrant Database and the Non-IPSI Registrant Database schematically illustrated in FIGS. 2A and 2B, respectively. Such databases can be expressed in the 4th Dimension® SQL Language, the Sybase language, or any other suitable database language which allows for database programming and database connectivity over the Internet. A suitable development program for creating a dynamic Web-site with the integrated database structures of FIGS. 2A1, 2A2 and 2B is the "4D Web SmartServer" from ACI, Inc. Data synchronization among such databases can be achieved using conventional data synchronization techniques well known in the art. In addition, a backup and mirroring program can be used to maintain data security. Preferably, the synchronized IPSD Servers are maintained by a team of network managers under the supervision of one or more webmasters.

Similarly, each IPSI Server **4** can be realized by, for example, the PowerMac® Internet Server from Apple Computer, Inc., or any other computing machine that can perform the function of a Server in a web-based, client-server type computer system architecture of the illustrative embodiment. As shown in FIG. 1, each IPSI Server is interfaced with an ISP **13** in a conventional manner. Each such IPSI Server is assigned a static TCP/IP address and a unique domain name on the Internet. Each IPSI Server is also provided with (i) Internet networking software to support the TCP/IP networking protocol, (ii) an Application Programming Interface (API) for application program development and (iii) Web-site server software for creating and maintaining hypermedia-type Web-sites containing product and/or service related information of a multi-media nature. Such Web-sites can be expressed in HTML and/or VRML or any other suitable language which allows for Web-site construction and Web-site connectivity. Web-site management software, such as Adobe® SiteMill™, should be used to maintain correct hyper-links for any particular Web-site. Preferably, the IPSI Servers are maintained by a team of network managers under supervision of one or more webmasters.

Each User (i.e. Client) Computer **5** can be realized by any computing system employing operating system (OS) software (e.g. Macintosh, Windows, Unix etc.) which supports an Internet browser program (e.g. Netscape, Internet Explorer, Mosaic, etc.) which includes Internet networking software that supports the TCP/IP networking protocol, and provides a GUI-based Web browser interface. Alternatively, Client Systems may also be realized by any of the following systems: (i) a Newton MessagePad 130 (running the Newton 2.0 Operating System and NetHopper™ Internet Software); (ii) a Pippin™ computer system from Apple Computer, Inc.;

(iii) a network computer (NC) that supports the Java™ programming language and Java applets expressed therewith; (iv) a Sony® WebTV Internet Terminal (supported by the WebTV Service provided by WebTV Network, Inc.); or the like. As shown in FIG. 1, each Client Computer is interfaced with an ISP **13** in a conventional manner. Each such Client System may be assigned a static TCP/IP address and a unique domain name on the Internet, or one may be dynamically assigned thereto by way of its ISP depending on its connectivity. Optionally, each Client System may include Web-site server software for creating and maintaining one or more hypermedia-type Web-sites in a manner well known in the art.

Typically, each Client System **5** will be maintained by consumers (and/or) potential consumers of products and/or services, about which information can be found on the Internet. It is understood, however, that Client System can be realized in the form of computer-based kiosks located in supermarkets, department stores, retail outlets, or other public location where products and/or services are being sold or offered for sale, and/or serviced. In one embodiment of the computer-based kiosk, a visual display screen, keyboard and pointing device would be provided in the conventional manner to enable consumers to operate its GUI-based browser and thus carry out the method of the present invention. In an alternative embodiment of the kiosk-based Client System, an integrated bar code reader is provided for reading UPC symbols printed on products (as well as UPNs printed on service-related brochures), and a visual display screen is provided for viewing product and service related information automatically displayed thereon in response to the entry of the UPSN information scanned into the system. The Database Structure of the IPSD Server

In the illustrative embodiment of the present invention, each data-synchronized IPSD Server **4** of the preferred embodiment maintains at least two different relational-type databases, namely: a IPSI Registrant Database for storing information about manufacturers and/or service providers whose products and/or services are registered with the system; and a Non-IPSI Registrant Database for storing information about manufacturers and/or service providers whose products and/or services are not registered with the system. A schematic representation of the IPSI Registrant Database is shown in FIG. 2A1, whereas a schematic representation of the Non-IPSI Registrant Database is shown in FIG. 2B.

As shown in FIG. 2A1, the relational-type IPSI Registrant Database maintained by each IPSD Server comprises a plurality of labeled information fields for each product or service "registered" therewith, namely: an IP/SN Information Field for storing information (e.g. numeric or alphanumeric string) representative of the Universal Product or Service Number (e.g. twelve digit UPC number) assigned to the product or service; a Company Name Information Field for storing information (e.g. numeric or alphanumeric string) representative of the name of the company making, selling or distributing the corresponding product or service; a URL Information Field for storing information (e.g. numeric or alphanumeric string) representative of the Universal Resource Locator (URL) or Universal Resource Locators (URLs) at which information (or the multimedia type) can be found on the Internet relating to the corresponding product or service; a Trademark/Servicemark Information Field for storing information (e.g. text and/or alphanumeric strings) representative of each trademark used in connection with the promotion, sale, distribution and/or use of the corresponding product or service, and preferably registered with

the United States Patent and Trademark Office (USPTO) or other governmental agency; a Product Description Information Field for storing information (e.g. text strings) descriptive of the corresponding product or service; an E-mail Address Information Field for storing information (e.g. numeric or alphanumeric string) representative of the e-mail address of the corresponding company (e.g. manufacturer) on the Internet; and a Status Information Field for storing information (e.g. numeric or alphanumeric string) representative of whether the company associated registered product or service has paid their monthly, quarterly or annual registration fees associated with registration within the IPSD Servers of the information finding system hereof. Notably, each information item contained with the information field shown along the same horizontal line of FIG. 2A1 are 15 related or linked.

In general, the URL stored in the URL Information Field specifies the address of an information resource on the Internet (Web), and thus may point to any one of the following types of information resources: a HTML document or file on the World Wide Web (expressed in the HyperText Markup Language); a single record in a database; the front-end of an Internet program such as Gopher; or the results of a query made using another program. In accordance with convention, the syntactic structure of each URL generally comprises: a Protocol Specifier, such as "http", "ftp", "gopher", "news", or "mailto", and specifies the type of resource to which the URL is pointing (i.e. connecting) to; a Host Indicator, represented by double slashes "//" if the URL is requesting information from a Web Server; Server Name comprising a Internet Domain Name (e.g. "www."), the address of the Web Server (e.g. "ibm."), and a designator (e.g. "com", "edu", "int", "mil", "net", "org", etc.) identifying who owns the server or where it is located; a Path Name, such as "Products/Computers/", indicating a path to the destination information file on the identified Server; and a Resource Name (including file extension, e.g. ".html"), such as "aptiva.html", identifying the actual named information file that contains existing information resource specified by the URL.

As used herein, as well as in the claims to Invention, the term "registered" and the variants thereof shall be understood to mean listed or having an entry within a database. Such listing or entry can be achieved in a variety of ways including, but not limited to the following: (i) by specific request of the associated company or business; or (ii) by the system administrator without a request and/or authorization of the corresponding company or business linked to the product or service.

Notably, each information item contained within the information field shown along the same horizontal line of FIG. 2A1 are symbolically related or linked. Different products and/or services of the same registrant or related registrant may also be linked together so that a user looking for information about a particular product or service is automatically provided URLs which are assigned to related products of the registrant. The automated linking of the URLs may satisfy the goals or objectives of a particular advertising and/or marketing campaign or product/service promotion program of the registrant company. As it may be desirable to relate particular products and services at particular points in time, the relationships therebetween can be dynamically changed dynamically within the IPSI Registrant Database. This can be effected by a straightforward database updating operation of the system administrator (or manager) who, in theory, can be located virtually anywhere throughout the world. Expectedly, such database updating

operations would be carried out using appropriate system access and security procedures well known in the art.

Inasmuch as the UPC data structure is presently employed as a universal product identifier (i.e. a primary data structure) in a majority of industries throughout the world, its twelve (12) digit numeric string will be a preferred UPN (in many applications) for purposes of carrying out the principles of the present invention. This twelve (12) digit human-readable number, printed on the bottom of each UPC label (and encoded within the bars and spaces of the UPC label itself), comprises: (i) a six digit manufacturer number assigned to the manufacturer by the Uniform Code Council, Inc. (UCC) of Dayton, Ohio, and consisting of a one digit "number system" number and a five digit manufacturer code; (ii) a five digit product number assigned to the product by the manufacturer; and (iii) a one digit modulo check digit (mathematically calculated) and added to each UPC number to ensure that the code has been read correctly by the bar code reader.

20 In order to provide the requester greater control over what information is actually displayed on its Client System, the URL Information Field of the IPSI Database shown in FIG. 2A1 contains a number of information subfields. As shown in FIG. 2A2, these information subfields comprise: a Product Advertisement Information Field for storing information representative of URLs pointing to information on the Internet relating to advertising and/or promotion of the product; a Product Specification (Description) Information Field for storing information representative of URLs pointing to information on the Internet relating to specifications on the product; a Product Update Information Field for storing information representative of URLs pointing to information on the Internet relating to product updates, recalls, notices, etc; a Product Distributor Information Field for storing information representative of URLs pointing to information on the Internet relating to distribution, sale and/or ordering of the product; a Product Warranty/Servicing Information Field for storing information representative of URLs pointing to information on the Internet relating to warranty, extended warranty offerings, servicing and maintenance of the product; a Product Incentive Information Field (e.g. rebates, discounts and/or coupons) for storing information representative of URLs pointing to information on the Internet relating to rebates, discounts and sales on the product; a Product Review Information Field for storing information representative of URLs pointing to information on the Internet relating to reviews, analysis, testing, inspection and/or comparison of the product; and Miscellaneous Information Field for storing information representative of URLs pointing to information on the Internet relating to miscellaneous aspects of the product. Each URL symbolically linked to each registered product in the Registered IPSI Database is categorized within one or more of these URL categories. Preferably, the manufacturer and its advertising and marketing personnel will actively participate in the selection of the URLs and their classification into the above-defined (or like) categories. Through such participation, the business objectives of any particular company can be promoted by the product information finding system of the present invention. Preferably, easy-to-read display screens are used to display and to select URLs contained within the above-described information subfields. In this way, the requester is provided with soley the kind of product-related information which he or she seeks.

65 It is understood that at present, few (if any) services have been assigned a UPC number in the manner that nearly all consumer products have been assigned in the contemporary

period. In spite of this fact, however, the present invention contemplates the need and utility of widespread assignment of UPC (or similar) numbers to particular services (as well as the imprinting of UPC (or similar) symbols on printed service brochures and advertisements. Notably, assigning UPC (or like) numbers to particular services, and labeling printed and graphical brochures and advertisements with such universal numbers, will provide a number of new opportunities hitherto unavailable.

In particular, service-related information could be easily found (i.e. located and accessed) on Web-sites using the system and method of the present invention, and thereafter the service easily procured through an electronic data transaction. In accordance with the present invention, this can be achieved by uniquely identifying and assigning "particular" services by a Universal Service Code (USC) which has many if not all of the attributes of a conventional UPC. While not necessary, a single digit may be optionally added to the USC in order to demark that services, rather than products are being identified. An example of such USC labeling would be the printing of an assigned UPC label (number) on: admission tickets to a theatrical, dramatic or musical performance and/or its playbill; admission tickets to a movie; admission tickets to a concert and/or its concert program; admission tickets to a sporting event and/or its sports program; admission tickets to an art, science or history museum; admission tickets to the zoo or botanical gardens; and the like. The UPC label would be encoded to identify a particular event at which an entertainment, educational or professional service is provided. The UPC label printed on the tangible medium associated with the promotion of or access to the particular service would then be registered with the IPSI Registrant Database of the system hereof, along with the name of the provider of the service, and a list of URLs that identify the Web locations at which particular kinds of information related to the particular service can be found (in accordance with the categories of FIG. 2A2).

As shown in FIG. 2B, the Non-IPSI Registrant Database maintained by each IPSD Server comprises a plurality of labeled information fields for each product or service that is not currently registered with the IPSD Server, namely: an IPSN (i.e. IPN and ISN) information Field for storing information (e.g. numeric or alphanumeric string) representative of the Universal Product or Service Number (e.g. a number from a UPC numbering system—a UPC number)—assigned to the non-registered product or service; a Company Name Information Field for storing information (e.g. numeric or alphanumeric string) representative of the name of the company making, selling or distributing the corresponding non-registered product or service; a Trademark/ Servicemark Information Field for storing information (e.g. text and/or alphanumeric strings) representative of each trademark (or servicemark) used in connection with the promotion, sale, distribution and/or use of the corresponding product or service, and preferably registered with the USPTO or other governmental agency; a Product Description Information Field for storing information (e.g. text strings) descriptive of the corresponding product or service; and an E-mail Address Information Field for storing information (e.g. numeric or alphanumeric string) representative of the e-mail address of the corresponding company (e.g. manufacturer) on the Internet; a Status Information Field for storing information (e.g. numeric or alphanumeric string) representative of whether the company associated non-registered product or service has been solicited by the IPSD Server, and on what dates registration solicitation has

occurred. Notably, each information item contained with the information field shown along the same horizontal line of FIG. 2A1 are related or linked. The information required to construct the Non-IPSI Registrant Database shown in FIG. 2B can be readily obtained from a number of commercially or publicly available information sources (e.g., the Universal Code Council, Inc., Dayton, Ohio; Quickresponse Services, Inc. Of Richmond, Calif.; General Electric Information Services (GEIS) of Delaware, Md.; Infotest International, <http://www.infotest.com>, etc.).

Communication Protocols For Carrying Out The System And Method Of The Present Invention

In general, there are a number of possible communication protocols that can be used to carry out the system and method of the present invention. In FIGS. 3A and 3B, a first communication protocol is schematically depicted for a first system having both the IPSI Finder and UPSN Search Modes of operation, whereas the basic operations carried out thereby are shown in FIGS. 4A and 4B. In FIGS. 5A and 5B, a second communication protocol is schematically depicted for both the IPSI Finder and UPSN Search Modes of operation, whereas the basic operations carried out thereby are shown in FIGS. 6A and 6B. The details of such protocols will be described below.

Referring to FIG. 3A, the high level structure is shown for a first-type of communication protocol that can be used among the Client System C_a , the IPSD Server S_b , and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its IPSI Finder Mode of operation. FIG. 4A provides a high level flow chart illustrating the steps involved in carrying out this communication protocol when the Client System is in its IPSI Finder Mode of operation.

In order to enter the IPSI Finder mode of the system, the user selects the "IPSI Finder" button on the GUI-based browser display screen. Then at Block A of FIG. 4A, a UPSN is provided as input to IPSD Server S_b , and in response thereto the Client System C_a requests the IPSD Server S_b to provide each registered URL_i stored in the IPSI Registrant Database.

At Block B in FIG. 4A, the IPSD Server S_b analyses the IPSI Registrant Database shown in FIG. 2A1 to determine whether or not a symbolically linked URL_i has been registered with UPSN_i that has been provided as input. If so, then the IPSD Server sends the symbolically linked URL_i to the Client System C_a . If not, then the IPSD records in the URL-request in the Non-IPSI Registrant Database shown in FIG. 2B.

At Block C in FIG. 4A, the Client System C_a receives the URL_i from the IPSD Server. Then, in response to a URL selection query based on the content of information subfields shown in FIG. 2A2 and displayed on the screen of the Client System C_a , the client system C_a requests the IPSI Server, identified by the user selected URL_i, to provide the product or service information located by the registered URL_i. Having accessed and displayed such product or service related information at the Client System, the user can review the information at the specified URL_i, acquire knowledge about the product or service, and may, if the option is provided at the URL-specified Web-site, purchase the product or procure (i.e. contract for) the service by way of an on-screen electronic commercial transaction. Such commercial transaction can involve product ordering, delivery specification, and financing through the use of credit or debit card transactions, COD arrangements, or any other financial arrangement acceptable to the vendor of the product or service.

Referring to FIG. 3B, the high level structure is shown for the first-type of communication protocol that can be used among the Client System C_a , the IPSD Server S_b , and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its UPSN Search Mode of operation. FIG. 4B provides a high level flow chart illustrating the steps involved in carrying out this communication protocol when the Client System is in its UPSN Search Mode of operation.

In order to enter the UPSN Search Mode of the system, the user selects the “UPSN Search” button on the GUI-based browser display screen. Then at Block A of FIG. 4B, a trademark TM_i (or servicemark SM_i) and/or a company name CN_i is provided as input to IPSD Server S_b by way of the browser display screen. Then in response thereto, the Client System C_a requests the IPSD Server S_b to provide each registered UPSN_{*i*} stored in the IPSI Registrant Database, and if so, then also its URL_{*i*} to the Client System.

At Block B in FIG. 4B, the IPSD Server S_b analyses the IPSI Registrant Database shown in FIG. 2A1 to determine whether or not a symbolically linked UPSN_{*i*} has been registered with a TM_i (or SM_i) and/or a company name CN_i that have been provided as input to the IPSD Server S_b by way of the browser display screen. If so, then the IPSD Server sends to the Client System C_a , the URL_{*i*} that is symbolically linked to the registered UPSN_{*i*}. If not, then the IPSD records in the URL-request in the Non-IPSI Registrant Database shown in FIG. 2B for future registration-request operations related to the T/SM_{*i*} sent by the Client System.

At Block C in FIG. 4B, the Client System C_a receives the URL_{*i*} from the IPSD Server. Then, in response to a URL selection query based on the contents of the information subfields shown in FIG. 2A2 and displayed on the screen of the Client System C_a , the Client System requests the IPSI Server, identified by the user selected URL_{*i*}, to provide the product or service information. Having accessed and displayed such product or service related information at the Client System, the user can review the information at the specified URL_{*i*}, acquire knowledge about the product or service, and may, if the option is provided at the URL-specified Web-site, purchase the product or procure (i.e. contract for) the service by way of an on-screen electronic commercial transaction, as described hereinabove.

Referring to FIG. 5A, the high level structure is shown for a second, alternative type of communication protocol that may be used among the Client System C_a , the IPSD Server S_b , and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its IPSI Finder Mode of operation. FIG. 6A provides a high level flow chart illustrating the steps involved in carrying out this communication protocol when the Client System is in its IPSI Finder Mode of operation.

In order to enter the IPSI Finder mode of the system, the user selects the “IPSI Finder” button on the GUI-based browser display screen. Then at Block A of FIG. 6A, a UPSN is provided as input to IPSD Server S_b , and in response thereto the Client System C_a requests the IPSD Server S_b to provide each registered URL_{*i*} stored in the IPSI Registrant Database.

At Block B in FIG. 6A, the IPSD Server S_b analyses the IPSI Registrant Database shown in FIG. 2A1 to determine whether or not a symbolically linked URL_{*i*} has been registered with UPSN_{*i*} that has been provided as input. If so, then in response to a URL selection query based on the contents of the information subfields shown in FIG. 2A2 and displayed on the screen of the Client System C_a , the IPSD Server S_b sends to the IPSI Server S_c hosting the user-

selected URL_{*i*}, a request for the IPSI Server S_c to send product or service information at the selected URL_{*i*} to the requesting Client System C_a . If the IPSD Server S_b determines that there does not exist a URL_{*i*} in the IPSI Registrant Database symbolically linked with the UPSN_{*i*} provided as input to the Client System C_a , then the IPSD Server S_b records the URL-request in the Non-IPSI Registrant Database for future registration operations with the company related to the input UPSN_{*i*}.

At Block C in FIG. 6A, the IPSI Server S_c receives the user-selected URL_{*i*} sent from the IPSD Server S_b and then provides to the Client System C_a , the product or service information located by the registered URL_{*i*}. Having accessed and displayed such product or service related information at the Client System, the user can review the information at the selected URL_{*i*}, acquire knowledge about the product or service, and may, if the option is provided at the URL-specified Web-site, purchase the product or service by way of an on-screen electronic commercial transaction.

Referring to FIG. 5B, the high level structure is shown for the second-type of communication protocol that can be used among the Client System C_a , the IPSD Server S_b , and the IPSI Server S_c of the IPSI finding system hereof when the GUI browser program on the Client System is in its UPSN Search Mode of operation. FIG. 6B provides a high level flow chart illustrating the steps involved in carrying out this communication protocol when the Client System is in its UPSN Search Mode of operation.

In order to enter the UPSN Search Mode of the system, the user selects the “UPSN Search” button on the GUI-based browser display screen. Then at Block A of FIG. 6B, a trademark TM_i (or servicemark SM_i) and/or a company name CN_i is provided as input to IPSD Server S_b by way of a dialogue box displayed on the browser display screen. In response thereto, the Client System C_a requests the IPSD Server S_b to determine whether or not a registered UPSN_{*i*} (and thus symbolically linked URL_{*i*}) is stored in the IPSI Registrant Database. If so, then in response to a URL-selection query based on the content of the information subfields shown in FIG. 2A2 and displayed on the display screen of the Client System C_a , the IPSD Server S_b sends the IPSI Server S_c hosting the user-selected URL_{*i*}, a request for the IPSI Server S_c to send product or service information at the selected URL_{*i*} to the requesting Client System C_a . If the IPSD Server S_b determines that there is no registered UPSN_{*i*} (and thus no symbolically linked URL_{*i*}) stored in the IPSI Registrant Database, then the IPSD Server records the URL request in the Non-IPSI Registrant Database for future registration operations with the company related by the UPSN_{*i*} sent by the Client System C_a .

At Block C in FIG. 6B, the IPSI Server hosting the user-selected URL_{*i*} receives the request from the IPSD Server S_b and then provides the product or service information identified by the registered URL_{*i*}. Having accessed and displayed such product or service related information at the Client System, the user can review the information at the specified URL_{*i*}, acquire knowledge about the product or service, and may, if the option is provided at the URL-specified Web-site, purchase the product or service by way of an on-screen electronic commercial transaction.

The communication protocols described above can be realized using any suitable programming language including, for example, an object-oriented programming language such as the Java programming language. Registration Of Products And Services With The IPSI System

The utility of the product and service finding tool of the present invention depends in large part on the number of

products and services registered with the IPSI system. In principle, numerous techniques may be employed separately as in combination with each other in order to construct the IPSI and Non-IPSI Registrant Databases supported by the IPSD Servers of the present invention. Five such techniques will be detailed below.

According to a first database construction technique, product registration requests (PRRs) are sent out to each and every company (i.e. manufacturer) which has been issued a six digit UPC Manufacturer Identification Number (MIN) by the UCC, Inc. For the various products which such manufacturers sell, the product registration request should ascertain the various information elements identified in the IPSI Registrant Database of FIGS. 2A1 and 2A2 in order to construct the same.

According to a second database construction technique, a global advertising campaign is launched in order to solicit the various information elements identified in the IPSI Registrant Database of FIG. 2A1 and 2A2 thus register the products (and services) of companies and businesses participating in the program. Preferably, such information is collected by way of e-mail to facilitate database construction operations.

According to a third database construction technique, the IPSI system itself continuously solicits product registrations over time in order to collect information from companies responding favorably to the solicitations. Such solicitation efforts can involve the issuance of product registration requests.

According to a fourth database construction technique, a number of commercial Internet search engines, such as Altavista™, Yahoo™, WebCrawler™, Lycos™, Excite™, and powerful off-line parallel computing machines are enlisted to analyze (i.e. mine) information on the World Wide Web in order to collect and link the information elements specified in the IPSI Registrant Database of FIG. 2A1.

Once an "initial" IPSI Registrant Database has been constructed using any one or more of the four database construction techniques described hereinabove, companies registered therewith can be periodically contacted in order to update, expand or otherwise the accuracy of the information contained within the database of the IPSI system.

According to a fifth database and preferred construction technique of the present invention, the IPSI Database of the system is initially "seeded" with several items of information obtained and related without the assistance of such manufacturers. Such information items include: (1) the six digit UPC Manufacturer Identification Numbers used in the UPC symbols (i.e. numbers) applied to the products thereof; and (2) the URLs of the Web home pages of UCC-registered manufacturers.

The first step of this database construction method involves obtaining the six digit manufacturer codes issued to specific manufacturers (or vendors) by the Uniform Code Council, Inc. of Dayton, Ohio, or be obtained from various commercial sources including GE Information Services, QuickResponse Services, Inc. At present, about 95,000 manufacturers identification numbers have been issued to manufacturers by the UCC. A string of six zeros (i.e. 000000) may be added to each one of these 95,000 or so six digit Manufacturer Identification Number in order to produce 95,000 or so 12 digit numbers (i.e. hereinafter referred to as "Manufacturer's Reference Numbers) for the 95,000 or so manufacturers (i.e. Vendors) listed in the IPSI Registrant Database under construction. As each such Manufacturer Reference Number has the same length as a UPC number of

its manufacturer, this number can be stored in the UPSN Information Field of the Database along with the corresponding manufacturers name being stored in the Company Name Information Field.

The second step of the method involves finding the URL of the Web home page of each of the 95,000 manufacturers who have been assigned a Manufacturers Identification Code and are listed in the Database. Such URL information can be found using conventional off-line search engines that use the name and address of the manufacturer to find the URL of the home page of its Web-site, if it has one. Such URLs are then added to the Database, along with e-mail and/or other addresses of the manufacturer symbolically linked thereto.

Having constructed the "seeded" Database, it can then be used to connect the Client System of users to the home page of Web-sites of manufacturers of particular products. Initially, when an Internet user provides as input to the Client System operating in its UPSN Search Mode, either the first six or all 12 digits of a UPC number (associated with a particular product or service), the IPSD Server need only compare the input UPC number against the six digit Manufacturer Identification Number portion of the Manufacturers Reference Number listed in the "seeded" Database. The corresponding URL of the matching manufacturer is returned to the Client System C. In instances of an initially seeded Database, wherein only the six digit Manufacturer Identification Numbers (or twelve digit Manufacturer Reference Numbers) are listed therein, the users are provided with the URLs of the home pages of the symbolically linked manufacturers (i.e. companies). Then, through mass mailings, advertisement and/or marketing and promotional efforts, the companies whose Manufacturer Identification Numbers (or Manufacturer Reference Numbers) are listed in the Database, as the case may be, are then contacted and requested to actively participate in linking the UPC numbers of their products with the URLs identifying wherein the Internet desired types of product-related information are located. When such URLs are registered within the Database, an inquiring Internet user knowing the corresponding UPC number can specify the exact location of a file containing information on the Web about any particular product (or service). Over time, the Manufacturer Reference Number of each manufacturer will become replaced by the UPC numbers and linked URLs on the WWW, and the users of the system can precisely pinpoint product-related information identified by the manufacturer, its marketing department and/or advertising agency. With manufacturer and advertiser participation and feedback, the initially seeded Database described hereinabove will gradually grow into a robust relational database richly filled with the various information items described in FIGS. 2A1 and 2A2, including the symbolically linked UPCs and URLs that point to very specific information files within IPSI Servers randomly located throughout the Internet.

Operation of the IPSI Finding System and Method

In each of the above-described embodiments of the system hereof shown in FIGS. 1A and 1B, the GUI-based Internet browser program of each Client System is provided with two independent modes of operation, namely: the "IPSI Finder Mode" and the "UPSN Search Mode".

When the "IPSI Finder" button is selected, the system (i.e. browser program) enters its the IPSI Finder Mode. Preferably, the user is provided with a choice of language (e.g. English, German, French, Japanese, Chinese, etc.) by way of an appropriate menu-selection screen. After the desired language selection is made, the home page is dis-

played upon the Client System's display screen. A typical display screen produced from the IPSD Server might read as follows:

Welcome to UPC-REQUEST™, the only Universal Product Information Finding System on the Internet.

Have you purchased a particular product, or are you considering the purchase of a particular product, on which you would like current, up-to-date information from the manufacturer or advertiser?

Look no further than the UPC-REQUEST™ Universal Product Information Finding System."

When the system is in this operational mode, as illustrated in FIGS. 3A, 4A and 5A, 6A, a Web-based information resource pertaining to any commercial product or service registered with the system can be displayed and selected by the user in order to automatically access the same from the Internet. Such information resources can include advertisements, specifications, operation descriptions, product simulations, purchase information, maintenance information, warranty and servicing information, product updates, distributor information, incentives (e.g. discounts, rebates, coupons, etc.), electronic data transaction screens, etc. In this mode, desired product or service information is obtained by simply manually entering the registered product's UPN (e.g. its UPC's 12 digit numerical string) or the registered service's USN (e.g. its UPC's 12 digit numerical string) into the dialogue box of the Internet browser or Internet application tool. When using the seeded IPSI Database described hereinabove, only the first six digits of the UPC number need be entered into the dialogue box. An exemplary display screen produced from the IPSD Server might be as follows:

"Simply enter the 12 digit UPC the particular product; click REQUEST, and then wait for the display of the list of Web locators (URLs) at which the desired product information can be found on the Internet."

Alternatively, a bar code symbol scanner can be used to enter the UPSN (e.g. UPC or USC number) into the system, thereby avoiding manual keyboard entry operations.

In response to such data entry operations, a list of URLs organized according to the information subfield classifications set forth in FIG. 2A2 are displayed on Client System C_a making the request of the IPSD Server. At this stage, another display screen would appear with an exemplary message as follows:

"Please select the URL from the displayed URL list using the information subfield product information category displayed above. This will connect you to the product information related to the selected URL. You can return to the URL display list at anytime."

Upon selecting a particular URL from the displayed URL list, video and audio information content are automatically displayed on the Client System from the IPSI Server hosting the selected URL.

When the "UPSN Search" button is selected, the system enters its UPSN Search Mode". Preferably, the user is provided with a choice of language (e.g. English, German, French, Japanese, Chinese, etc.) by way of an appropriate menu-selection screen.

When the system is in this operational mode, as illustrated in FIGS. 3B, 4B and 5B, 6B, a predesignated information resource pertaining to any commercial product or service registered with the system can be automatically accessed from the Internet and displayed from the Internet browser of a Client System. Such information resources can include advertisements, specifications, operation descriptions, prod-

uct simulations, product upgrade information, purchase information, maintenance information, warranty and servicing information, etc. In this mode, desired product or service information is obtained by simply entering the registered product's trademark(s) or servicemark(s) and/or associated company name into the dialogue box of the Internet browser or Internet application tool. An exemplary display screen produced from the IPSD Server might be as follows:

"Simply enter the trademark used in connection with the particular product and/or the company name of the product's manufacturer; click REQUEST, and then wait for the display of a list of Web locators (URLs) at which desired types of product information can be found on the Internet."

10 In response to such data entry operations, a list of URLs organized according to the information subfield classifications set forth in FIG. 2A2 are displayed on Client System placing the request. Upon selecting a particular URL from the displayed list thereof, video and audio information content are automatically displayed on the Client System from the IPSI Server hosting the selected URL.

15 In an alternative embodiment of the present invention, the "IPSI Finder Mode" and the "UPSN Search Mode" can be integrated into a single server application so that there is no need or desire to manually select IPSI Finder and UPSN Search Mode buttons. In such an embodiment, the interaction between the IPSD Server and the requesting Client System can be designed to support the following Web server display screens and script underlying the same:

20 "Welcome to UPC-REQUEST™, the only Universal Product Information Finding System on the Internet.

25 Have you purchased a particular product, or considering the purchase of a particular product, on which you would like current, up-to-date information from the manufacturer or advertiser?

30 Look no further than the UPC-REQUEST™ Universal Product Information Finding System."

35 "Simply enter the 12 digit UPC number of the particular product, click REQUEST, and await from the list of Web locators (URLs) selected by the manufacturer at which the desired product information can be found?

40 "If you do not know the UPC number associated with the product you are looking for, then simply enter the trademark used in connection with the particular product and/or the company name of the manufacturer, Then click REQUEST, and wait for the display of the list of Web locators (URLs) at which the desired product information can be found?

45 "Please select the URL from the displayed URL list by clicking on it. This will connect you to the product information related to the selected URL. You can return to the URL display list at anytime."

50 Notably, such an integrated Web server application can be realized in a variety of ways. The exact words and graphics used to create an interactive script for an integrated Web server application will vary from embodiment to embodiment.

55 The Automated Registration Solicitation Mode Of The System

60 In the illustrative embodiments of the present invention, the data-synchronized IPSD Servers of the system hereof are also provided with an "Automated Registration Solicitation Mode" programmed by the webmaster (or administrator) of the IPSI Web-site. In this mode, each IPSD Server analyzes the data collected within its Non-IPSI Registrant Database. The data analysis determines: (1) which "unregistered"

products or services in the Non-IPSI Registrant Database were the subject of an information request at the IPSD Server; (2) how many hits (requests) were made for the product or service within a predetermined length of time (e.g. one week) by Internet users; and (3) whether the number of requests exceeds a particular "request threshold" (e.g. 100 requests in week period). Then, for each unregistered product (or service) which has exceeded the request threshold, the IPSD Server automatically sends an e-mail message to the associated company. Preferably, the e-mail message is designed to (i) inform the company of recent information requests for their products and/or services, and (ii) solicit the registration of such products and/or services with the IPSD Server. Once registered with the system, such products and services can be easily found on the Internet by anyone wishing to use the product and service finding techniques of the present invention.

The present invention has been described in great detail with reference to the above illustrative embodiments. It is understood, however, that numerous modifications will readily occur to those with ordinary skill in the art having had the benefit of reading the present disclosure.

For example, in the illustrative embodiments described hereinabove, separate databases are maintained by each data-synchronized IPSD Server for (i) registered products and services within the system, and (ii) non-registered products and services within the system. Notably, the reasons for using a dual database design of this sort would be based largely on economics, namely: only those companies who have paid the required maintenance (or registration) fees get their products (or services) and linked URLs "registered" with the system, whereas non-paying companies do not get their products (or services) and linked URLs registered with the system, regardless of how such product-URL or service-URL information is ascertained (e.g. by solicitation versus data mining).

Thus it is contemplated that in some embodiments of the present invention, each IPSD Server will be designed to maintain only a single database for maintaining product-URL and service-URL information currently available on the Internet. In such embodiments of the present invention, the concept of "non-registered" products and services will be avoided altogether, since the system implementation and administration (in all likelihood) will be designed to not require companies to pay maintenance (or registration) fees in order that their products (or services) and linked URLs are registered with the IPSI system. Instead, some alternative income producing scheme will be used in such embodiments of the present invention (e.g., advertisement space, user fees, subscription fees, Internet browser-licensing fees, etc.) for system maintenance and administration.

When practicing the system and method of the present invention, it is preferred that the UPC label (with its human-readable UPC number) assigned to the particular product be attached, embossed or otherwise embodied on an accessible surface thereof. In addition to applying the UPC label to the external packaging of the product, it is preferred that the UPC label also be printed on any and all product instructions and manuals provided with the product. In this way, the UPC number can be easily read by a human being and then used to access a desired type of product information using the system and method of the present invention.

In order that the system hereof can be used to find information pertaining to large products such as automobiles, motorcycles, skidoos, farm machinery, boats, etc., the present invention also contemplates assigning UPC numbers to such products and attaching, embossing or

otherwise embodying the same on an accessible surface thereof. Also, the UPC label should be printed on all instruction booklets and/or operating manuals normally provided with the product. In this way, information related to any particular product that is posted anywhere on the Internet and linked to URLs registered with the IPSD Servers of the system hereof can be readily found using the uniquely assigned UPC number assigned thereto by the manufacturer at the time of sale. Notably, multimedia information about such products can be most helpful in regard to the operation, repair and servicing of such products.

The system and method of the present invention has been shown to combine the use of UPC numbers, trademarks and company names when making a product information request of the system. It is understood, however, that the present invention can be practiced using any one of these items of information, alone or in combination with each other, in order to place a product (or service) information request with the system hereof.

These and all other such modifications and variations are deemed to be within the scope and spirit of the present invention as defined by the accompanying claims to Invention.

What is claimed is:

1. A system for finding and serving information pertaining to a particular consumer product and the manufacturer thereof on the Internet, said system comprising:

(1) an Internet database serving subsystem operably connected to the infrastructure of the Internet and including

(1A) an information storage subsystem for storing first and second sets of information, said first set of information being representative of

(i) a plurality of manufacturer identification numbers (MINs) assigned to a plurality of manufacturers of consumer products, each said MIN being assigned to one of said plurality of manufacturers of consumer products, and

(ii) a plurality of home-page specifying URLs symbolically linked to said plurality of MINs, each said home-page specifying URL being symbolically linked to one of said plurality of manufacturers of consumer products and specifying the location of a manufacturer World Wide Web (WWW) site located on the Internet, having a home page on the WWW and being related to one of said plurality of manufacturers of consumer products, and

said second set of information being representative of

(i) a plurality of universal product numbers (UPN) assigned to a plurality of consumer products made by said plurality of manufacturers, each said UPN being assigned to one of said plurality of consumer products, and

(ii) a plurality of product-information specifying URLs symbolically linked to said plurality of UPNs, each said product-information specifying URL including one of said plurality of MINs, and being symbolically linked to one of said plurality of consumer products and specifying the location of an information resource located on the Internet related to at least one of said plurality of consumer products, and

(1B) request servicing means for servicing a request for information about one of said plurality of products located on the Internet, made by a client subsystem operably connected to the Internet, wherein said request is transmitted to said Internet database serving subsystem for processing and includes information representative of the UPN assigned to said consumer

product on which product-related information located on the Internet is being sought by a consumer using said client subsystem,
 wherein said request servicing means automatically compares the UPN included in said request against said plurality of MINs stored in said information storage subsystem, and
 (i) automatically returns to said client subsystem, the home-page specifying URL symbolically linked to the MIN contained within the UPN included in said request if, at the time said request was made, no product-information specifying URLs have been symbolically linked to the UPN included in said request, within said information storage subsystem, and
 (ii) automatically returns to said client subsystem, one or more of URLs symbolically linked to said UPN included in said request, if, at the time said request was made, one or more product-information specifying URLs have been symbolically linked to the UPN included in said request, within said information storage subsystem; and
 (2) a plurality of product-information containing servers, each said product-information containing server being connected to the Internet and storing product-related information resources related to at least one of
 (i) one or more of the WWW sites of said plurality of manufacturers of consumer products, and
 (ii) one or more of said plurality of consumer products, wherein the location of each said product-related information resource on the Internet is specified by one said plurality of product-information specifying URLs, and
 wherein the location of the home page of each said WWW site is specified by one of said plurality of home-page specifying URLs, and
 wherein said client subsystem can use
 (i) the one or more product-information specifying URLs returned by said request servicing means to access product-related information from said one or more of said plurality of product-related information containing servers, and
 (ii) the home-page specifying URL returned from said request servicing means to access the home-page of the manufacturer's WWW site from one or more of said plurality of product-related information containing servers.

2. The system according to claim 1, wherein said one or more URLs are arranged for display on said client subsystem in accordance with a predetermined product-related information classification scheme.

3. The system according to claim 1, wherein one or more of said product-related information resources comprise HTML-encoded documents located on the WWW.

4. The system according to claim 3, wherein one or more of said product-information specifying URLs specify the location of said HTML-encoded documents located on the WWW.

5. The system according to claim 1, wherein said client subsystem is a WWW-enabled computer system selected from the group consisting of: a computer-based kiosk provided with a first WWW browser and a first bar code symbol reading device operably connected to said first WWW browser; a portable computer provided with a second WWW browser and a second bar code symbol reading device operably connected to said second WWW browser; and a desktop computer system provided with a third WWW

browser and a third bar code symbol reading device operably connected to said third WWW browser.
 6. The system according to claim 1, wherein said UPN is a UPC.
 7. The system of claim 1, wherein said Internet database serving subsystem comprises an Internet information server and a relational database subsystem operably connected to said Internet database serving subsystem.
 8. A method of finding and serving information pertaining to a particular consumer product and the manufacturer thereof on the Internet, said method comprising the steps of:
 (a) storing first and second sets of information in an Internet database serving subsystem operably connected to the infrastructure of the Internet,
 said first set of information being representative of
 (i) a plurality of manufacturer identification numbers (MINs) assigned to a plurality of manufacturers of consumer products, each said MIN being assigned to one of said plurality of manufacturers of consumer products, and
 (ii) a plurality of home-page specifying URLs symbolically linked to said plurality of MINs, each said home-page specifying URL being symbolically linked to one of said plurality of manufacturers of consumer products and specifying the location of a manufacturer World Wide Web (WWW) site located on the Internet, having a home page on the WWW and being related to one of said plurality of manufacturers of consumer products, and
 said second set of information being representative of
 (i) a plurality of universal product numbers (UPN) assigned to a plurality of consumer products made by said plurality of manufacturers, each said UPN being assigned to one of said plurality of consumer products, and
 (ii) a plurality of product-information specifying URLs symbolically linked to said plurality of UPNs, each said product-information specifying URL including one of said plurality of MINs, and being symbolically linked to one of said plurality of consumer products, and specifying the location of an information resource located on the Internet related to at least one of said plurality of consumer products; and
 (b) transmitting to said Internet database serving subsystem, a request made by a client subsystem operably connected to the Internet, for product-related information on the Internet about one of said plurality of consumer products, said request including information representative of the UPN assigned to a particular consumer product on which product-related information located on the Internet is being sought by a consumer using said client subsystem,
 (c) said Internet database serving subsystem receiving said request and automatically comparing the UPN included in said request against said plurality of MINs stored in said information storage subsystem, and
 (i) automatically returning to said client subsystem, the home-page specifying URL symbolically linked to the MIN contained within the UPN included in said request, if, at the time said request is made, no product-information specifying URLs have been symbolically linked to the UPN included in said request, within said information storage subsystem, and
 (ii) automatically returning to said client subsystem, one or more of URLs symbolically linked to said

UPN included in said request, if, at the time said request is made, one or more product-information specifying URLs have been symbolically linked to the UPN included in said request, within said information storage subsystem; and

(d) said client subsystem using one or more URLs returned during step (c) to access product-related information resources and the home-page of manufacturer WWW sites from one or more product-related information containing servers, wherein each said product-related information containing server is connected to the Internet and stores product-related information resources related to at least one of

(i) one or more of the WWW sites of said manufacturers of consumer products, and

(ii) one or more of said plurality of consumer products, wherein the location of each said consumer product-related information resource on the Internet is specified by one said product-information specifying URL, and

wherein the location of the home-page of each said WWW site is specified by one of said plurality of home-page specifying URLs.

9. The method according to claim 8, wherein said one or more product-information specifying URLs are arranged for display on said client subsystem in accordance with a predetermined product-related information classification scheme.

10. The method according to claim 8, wherein one or more of said product-related information resources comprise HTML-encoded documents on the WWW, and wherein one or more of said product-information specifying URLs specify the location of said HTML-encoded documents.

11. The method according to claim 8, wherein said client subsystem is a WWW-enabled computer system selected from the group consisting of: a computer-based kiosk provided with a first WWW browser and a first bar code symbol reading device operably connected to said first WWW browser; a portable computer provided with a second WWW browser and a second bar code symbol reading device operably connected to said second WWW browser; and a desktop computer system provided with a third WWW browser and a third bar code symbol reading device operably connected to said third WWW browser.

12. The method according to claim 8, wherein said UPN is a UPC.

13. The method of claim 8, wherein said Internet database serving subsystem comprises an Internet information server and a relational database subsystem operably connected to said Internet information server.

14. A system for finding and serving the home-page of a World Wide Web (WWW) site of a manufacturer of a particular consumer product, said system comprising:

- (1) an Internet database serving subsystem operably connected to the infrastructure of the Internet and including
- (1A) an information storage subsystem for storing a set of information being representative of
- (i) a plurality of manufacturer identification numbers (MINs) assigned to a plurality of manufacturers of consumer products, each said MIN being assigned to one of said plurality of manufacturers of consumer products, and
- (ii) a plurality of home-page specifying URLs symbolically linked to said plurality of MINs, each said home-page specifying URL being symbolically linked to one of said plurality of manufacturers of consumer products and specifying the location of a

manufacturer WWW site located on the Internet, having a home page on the WWW and being related to one of said plurality of manufacturers of consumer products, and

- 5 (1B) request servicing means for servicing a request made by a client subsystem operably connected to the Internet, wherein said request is transmitted to said Internet database serving subsystem for processing and includes information representative of the UPN assigned to said consumer product on which product-related information located on the Internet is being sought by a consumer using said client subsystem, wherein said request servicing means automatically compares the UPN included in said request against said plurality of MINs stored in said information storage subsystem, and automatically returns to said client subsystem, the home-page specifying URL symbolically linked to the MIN contained within the UPN included in said request;
- 10 (2) a plurality of product-information containing servers, each said product-information containing server being connected to the Internet and storing information resources including the home-page of at least one or more of the WWW sites of said plurality of manufacturers of consumer products, wherein the location of the home-page of each said WWW site is specified by one of said plurality of home-page specifying URLs, and
- 15 wherein said client subsystem can use the home-page specifying URL returned by said request servicing means to access from at least one of said product-information containing servers, the home-page of the WWW site of the manufacturer symbolically linked to said MIN contained within the UPN included in said request.

20 15. The system according to claim 14, wherein said home-page specifying URL returned by said request servicing means is automatically displayed on said client subsystem for accessing the home-page of the WWW site of the manufacturer symbolically linked to said MIN contained within the UPN included in said request.

25 16. The system according to claim 14, wherein one or more of said product-related information resources comprise HTML-encoded documents located on the WWW.

30 17. The system according to claim 16, wherein one or more of said product-information specifying URLs specify the location of said HTML-encoded documents on the WWW.

35 18. The system according to claim 14, wherein said client subsystem is a WWW-enabled computer system selected from the group consisting of: a computer-based kiosk provided with a first WWW browser and a first bar code symbol reading device operably connected to said first WWW browser; a portable computer provided with a second WWW browser and a second bar code symbol reading device operably connected to said second WWW browser; and a desktop computer system provided with a third WWW browser and a third bar code symbol reading device operably connected to said third WWW browser.

40 19. The system according to claim 14, wherein said UPN is a UPC.

45 20. The system of claim 14, wherein said Internet database serving subsystem comprises an Internet information server and a relational database subsystem operably connected to said Internet database serving subsystem.

50 21. A method of finding and serving the home-page of the World Wide Web (WWW) site of a manufacturer of a particular consumer product, said method comprising the steps of:

(a) storing a set of information in an Internet database serving subsystem operably connected to the infrastructure of the Internet,
 said set of information being representative of
 (i) a plurality of manufacturer identification numbers (MINs) assigned to a plurality of manufacturers of consumer products, each said MIN being assigned to one of said plurality of manufacturers of consumer products, and
 (ii) a plurality of home-page specifying URLs symbolically linked to said plurality of MINs, each said home-page specifying URL being symbolically linked to one of said plurality of manufacturers of consumer products and specifying the location of a manufacturer World Wide Web (WWW) site located on the Internet, having a home page, and being related to one of said plurality of manufacturers of consumer products;

(b) transmitting to said Internet database serving subsystem, a request made by a client subsystem operably connected to the Internet, for product-related information on the Internet about one of said plurality of consumer products, said request including information representative of the UPN assigned to a particular consumer product on which product-related information located on the Internet is being sought by a consumer using said client subsystem;

(c) said Internet database serving subsystem receiving said request and automatically comparing the UPN included in said request against said plurality of MINs stored in said information storage subsystem, and automatically returning to said client subsystem, the home-page specifying URL symbolically linked to the MIN contained within the UPN included in said request; and

5 (d) said client subsystem using the home-page specifying URL returned during step (c) to access the home-page of the WWW site of the manufacturer symbolically linked to the MIN contained within the UPN included in said request.

10 22. The method according to claim 21, wherein said home-page specifying URL returned during step (c) is automatically displayed on said client subsystem for accessing the home-page of the WWW site of the manufacturer symbolically linked to said MIN contained within the UPN included in said request.

15 23. The method according to claim 21, wherein one or more of the home-pages of said WWW sites comprise HTML-encoded documents located on the WWW.

20 24. The method according to claim 23, wherein one or more of said home-page specifying URLs specify the location of said HTML-encoded documents on the WWW.

25 25. The method according to claim 21, wherein said client subsystem is a WWW-enabled computer system selected from the group consisting of: a computer-based kiosk provided with a first WWW browser and a first bar code symbol reading device operably connected to said first WWW browser; a portable computer provided with a second WWW browser and a second bar code symbol reading device operably connected to said second WWW browser; and a desktop computer system provided with a third WWW browser and a third bar code symbol reading device operably connected to said third WWW browser.

30 26. The method according to claim 21, wherein said UPN is a UPC.

27. The method of claim 21, wherein said Internet database serving subsystem comprises an Internet information server and a relational database subsystem operably connected to said Internet database serving subsystem.

* * * * *



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(12) United States Patent
Brook et al.

(10) Patent No.: US 6,170,746 B1
(45) Date of Patent: Jan. 9, 2001

(54) SYSTEM AND METHOD FOR TRACKING DRUGS IN A HOSPITAL

5,845,264 * 12/1998 Nelhaus 235/375
 6,021,392 * 2/2000 Lester et al. 705/2

(75) Inventors: **Douglas J. Brook; Mark S. Morrow, both of Dayton; Raymond D. Tavener, Lebanon, all of OH (US)**

* cited by examiner

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Assistant Examiner—Larry D. Taylor

(74) *Attorney, Agent, or Firm*—McAndrews, Held & Malloy, Ltd.

(73) Assignee: **Monarch Marking Systems, Inc.**,
Dayton, OII (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/133,762

(22) Filed: Aug. 12, 1998

(51) Int. Cl.⁷ G06F 17/60

(52) U.S. Cl. 235/385; 235/462.01

(58) **Field of Search** 235/380, 382,
235/383, 385, 375, 462.15, 462.01, 462.45;
705/2, 3, 22, 28

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(57) **ABSTRACT**

A drug tracking system and method for use in hospitals, pharmacies, etc. uses a portable barcode scanning and printing system to reduce errors in the tracking information and to facilitate the ease and efficiency of the drug tracking operation. The portable scanning and printing system automatically prompts the user to enter data necessary for tracking one or more drugs. The portable scanning and printing system also prompts the user to select a particular drug and/or quantity. Automatic verification of the user entered data is performed by the portable system so as to warn the user via a displayed message that the wrong drug and/or quantity was selected or to prompt the user to recount and/or re-enter data so that any discrepancies can be immediately corrected. The portable scanning and printing system also prints alpha-numeric and barcode information on labels that are used to continue the drug tracking operation at other locations. Because the portable scanning and printing system is mobile, all of the drug tracking operations can be performed at the drug's situs to improve the accuracy of the drug tracking operation.

43 Claims, 27 Drawing Sheets

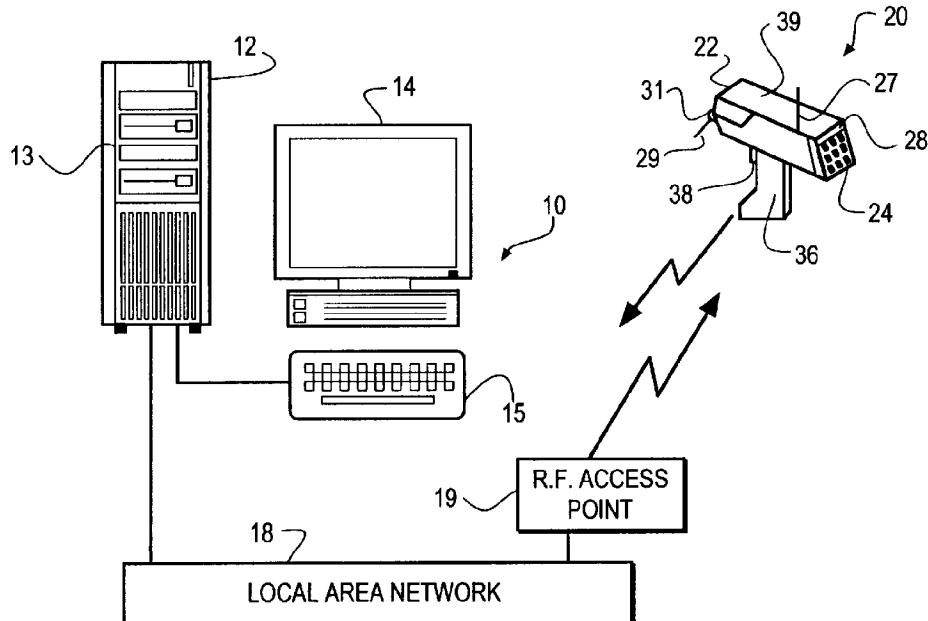


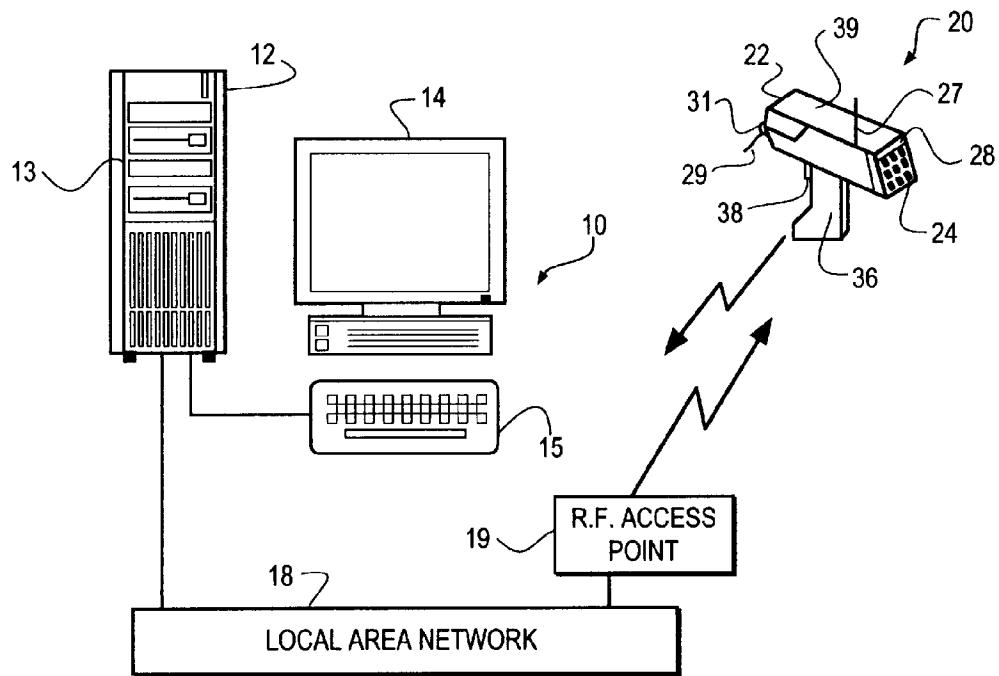
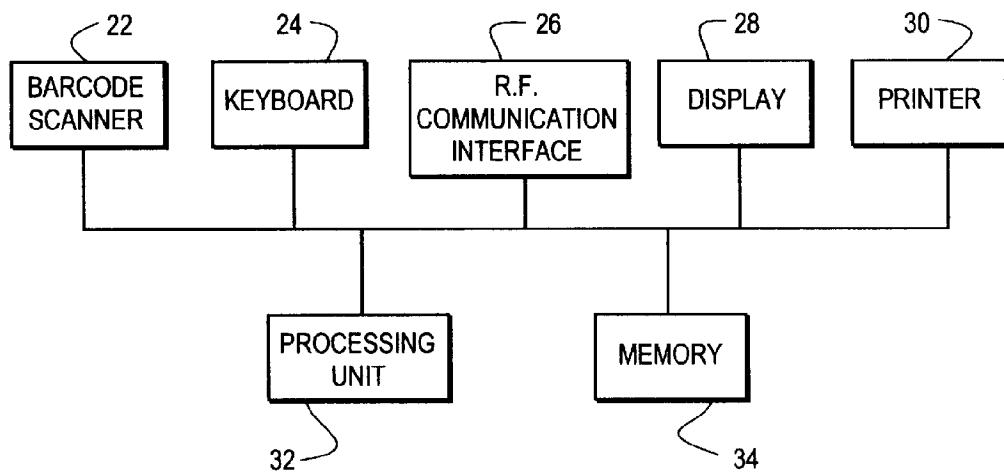
FIG. 1**FIG. 2**

FIG. 3A

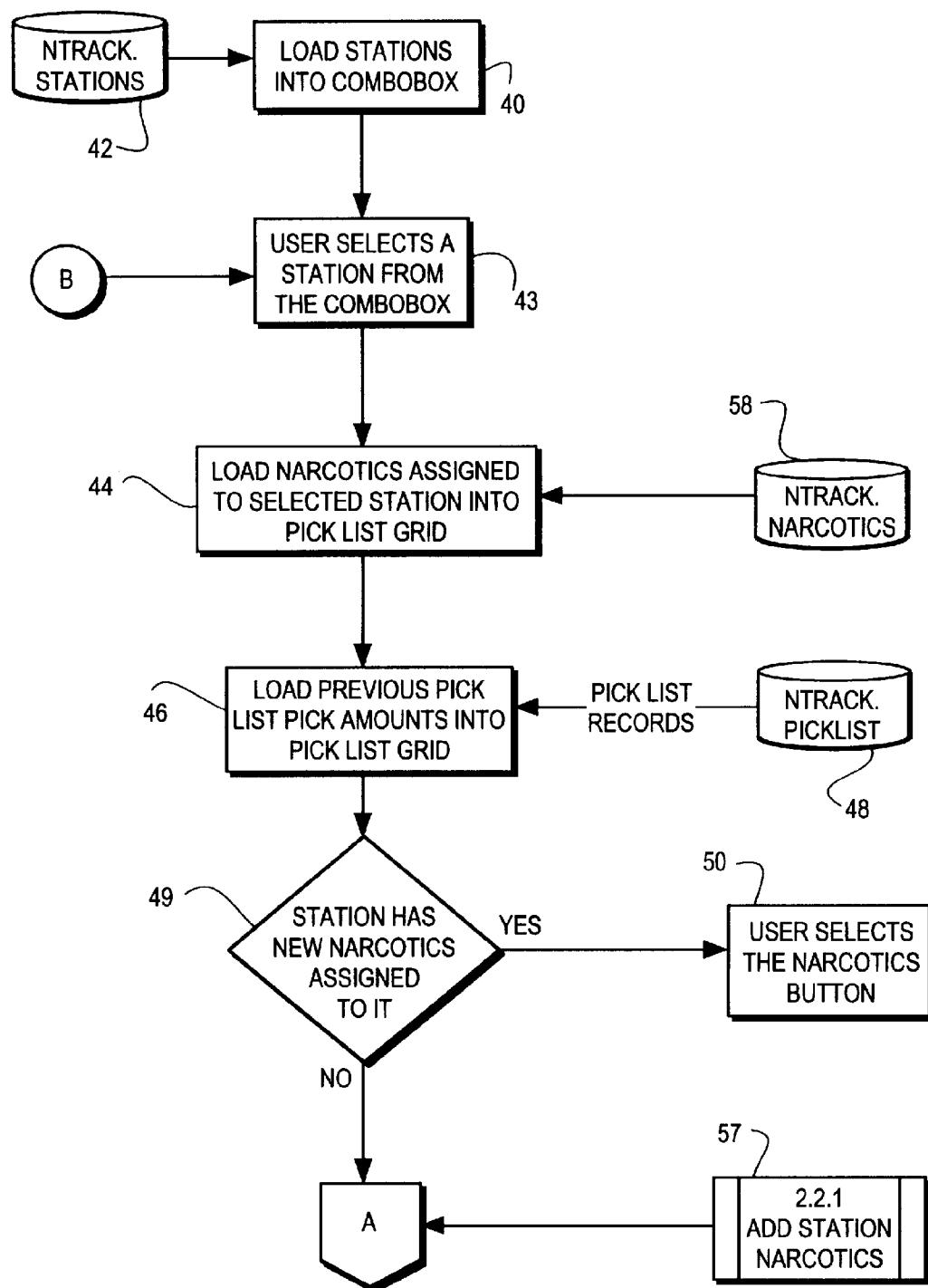


FIG. 3B

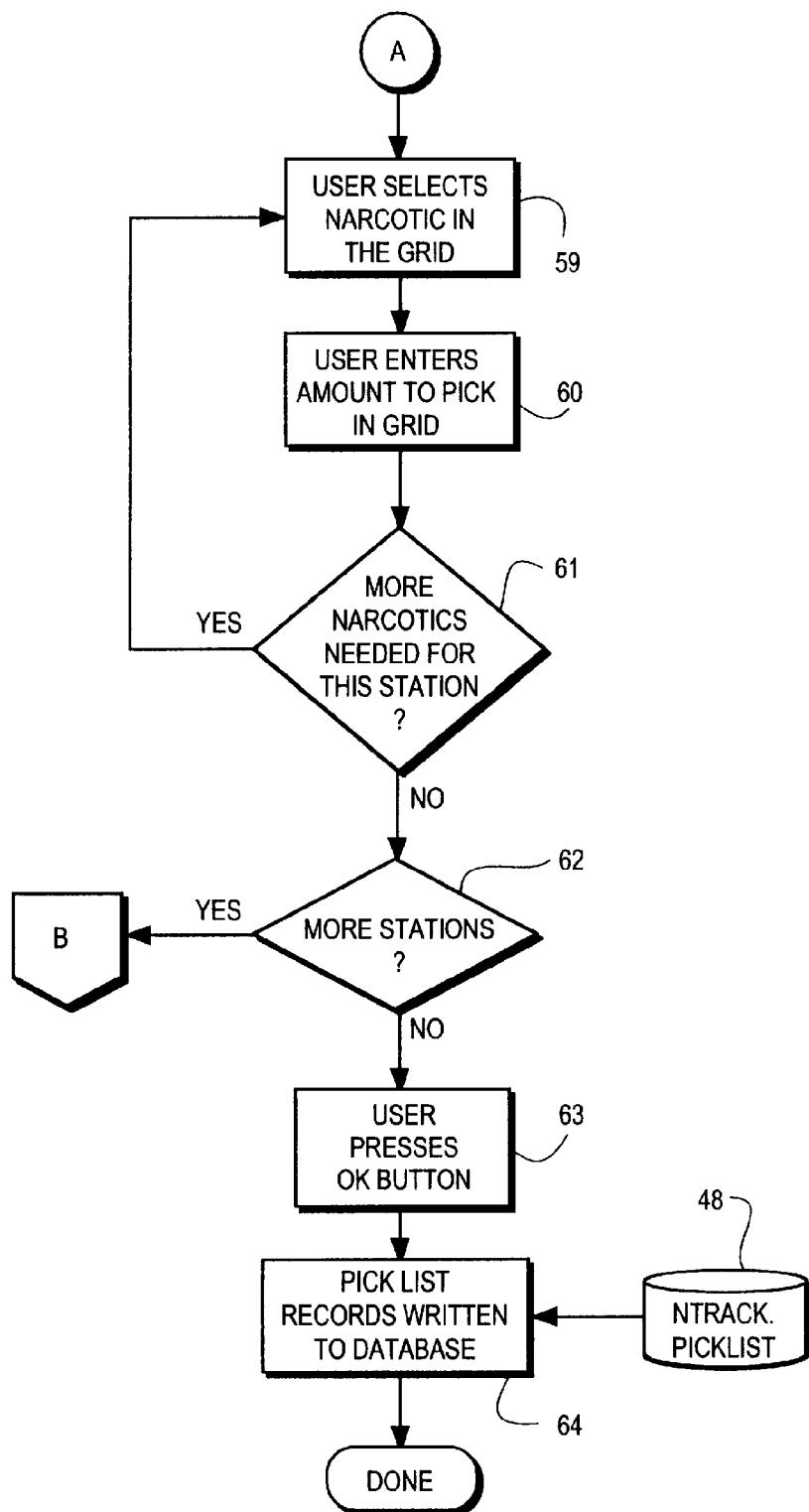


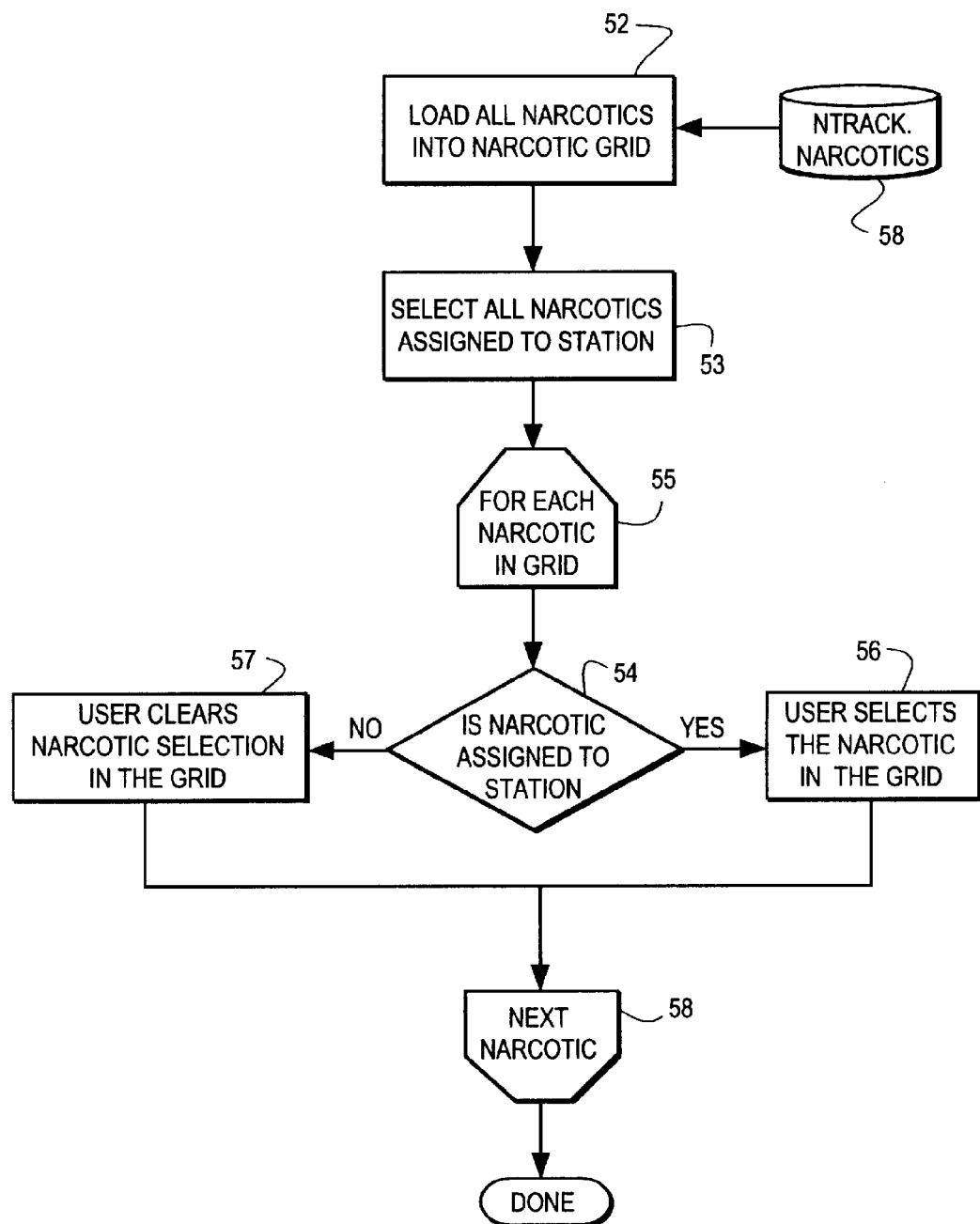
FIG. 3C

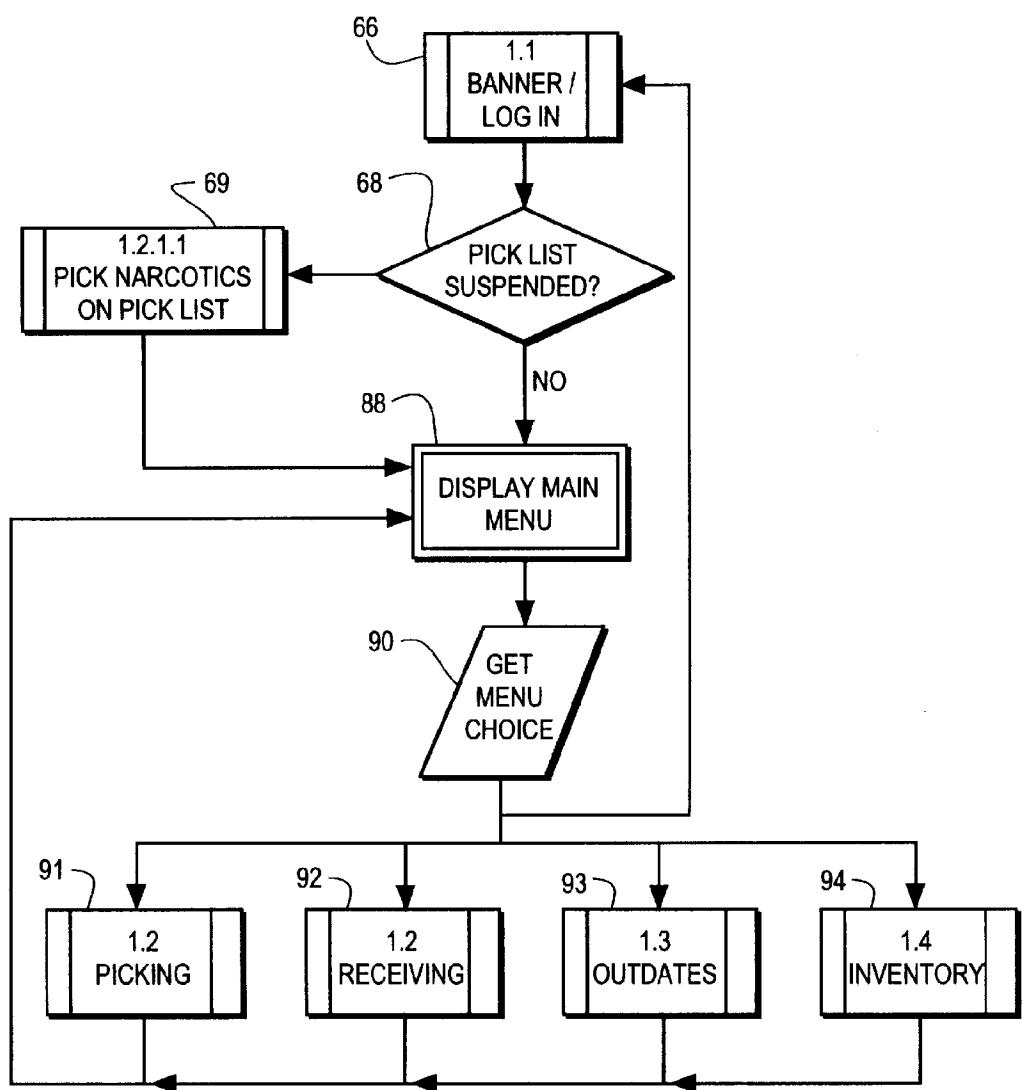
FIG. 4

FIG. 5

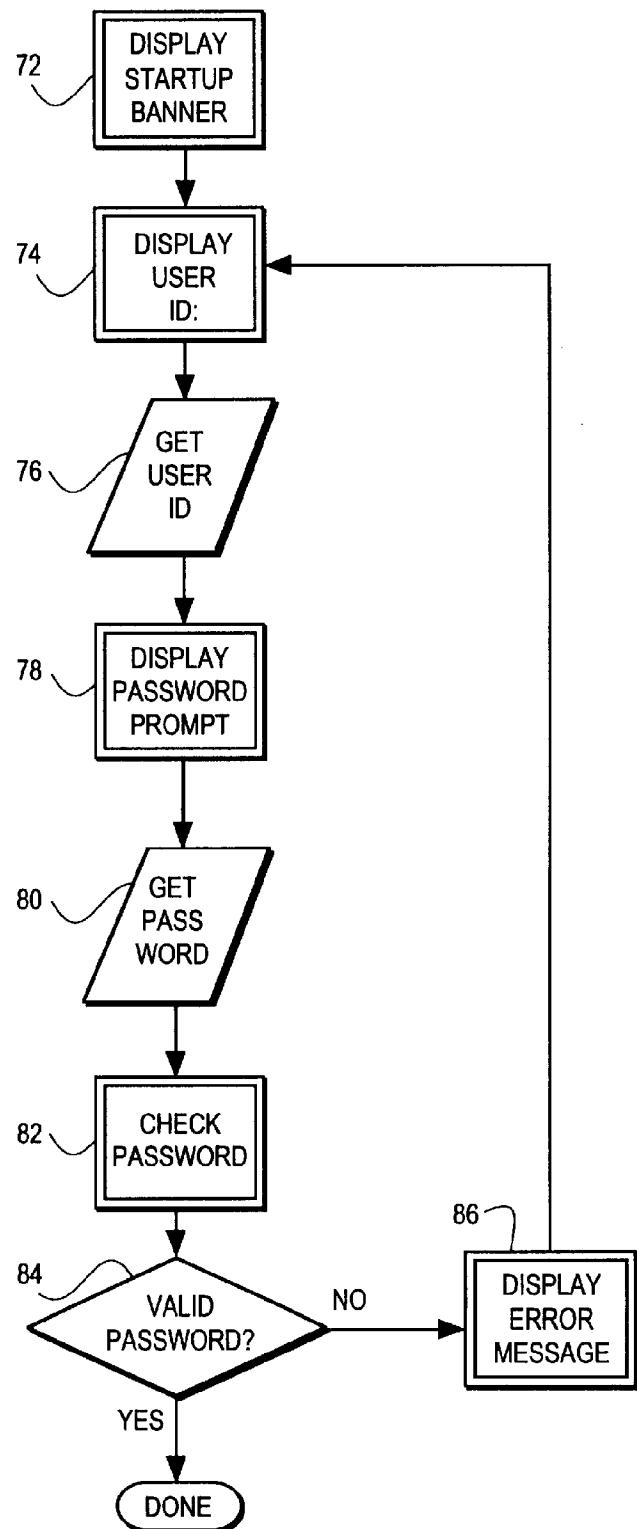


FIG. 6A

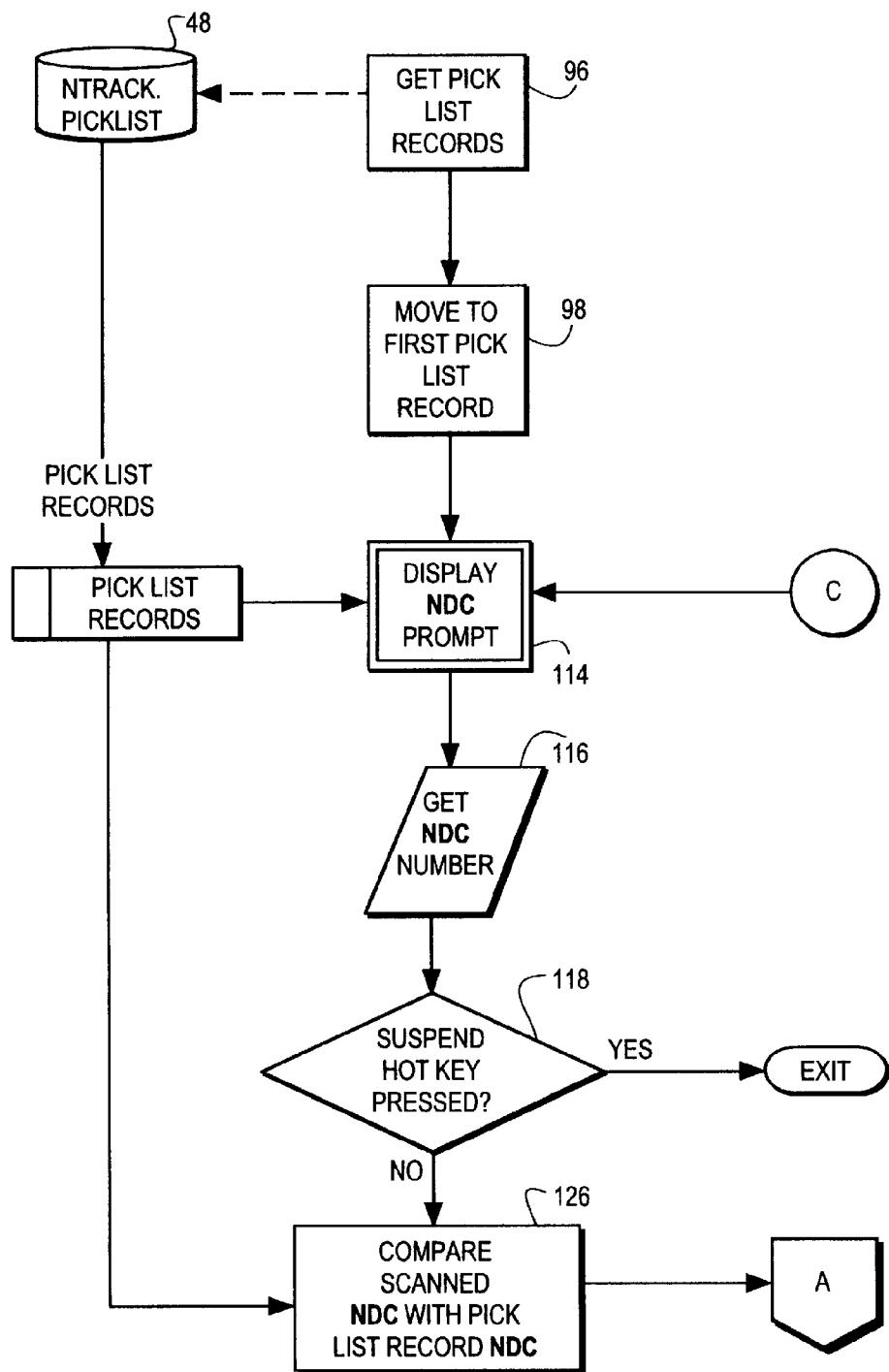


FIG. 6B

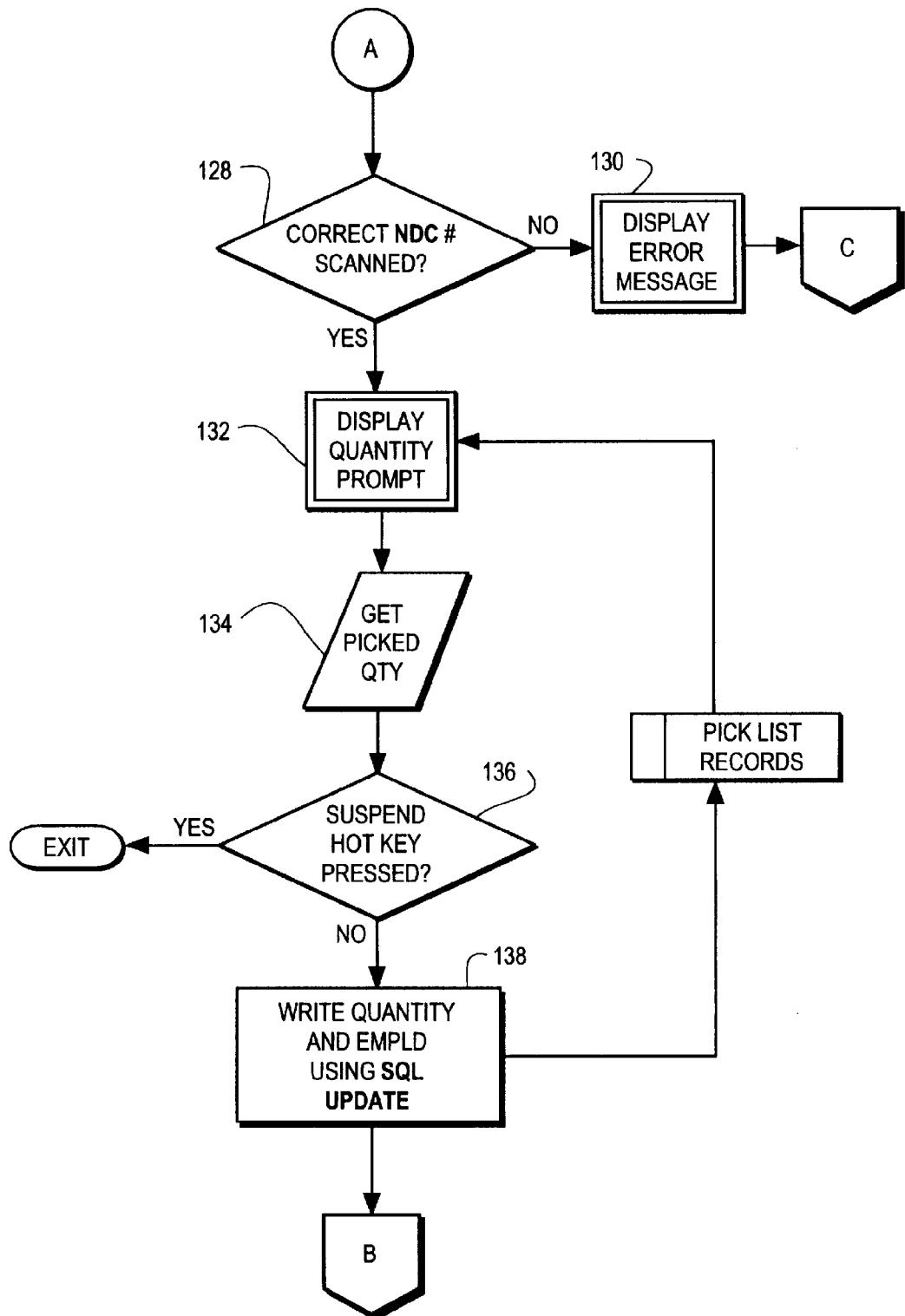


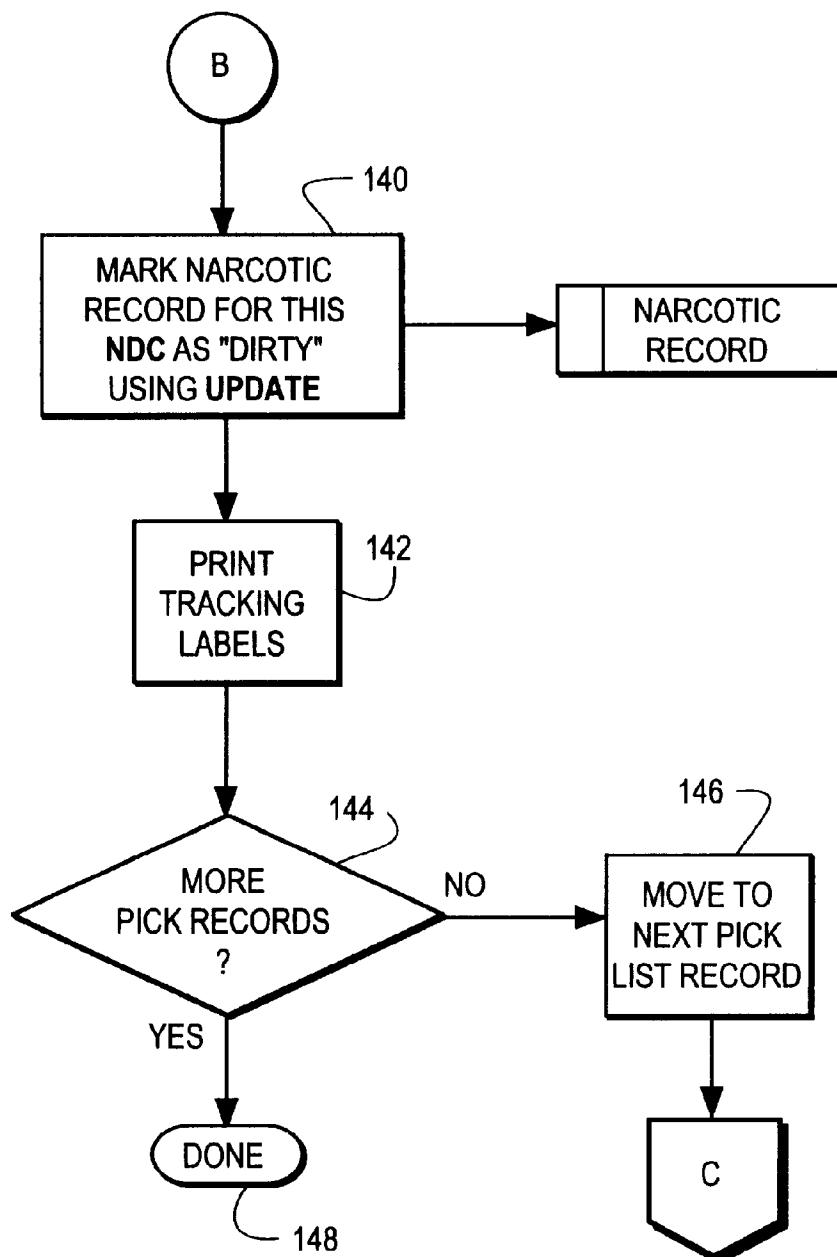
FIG. 6C

FIG. 7A

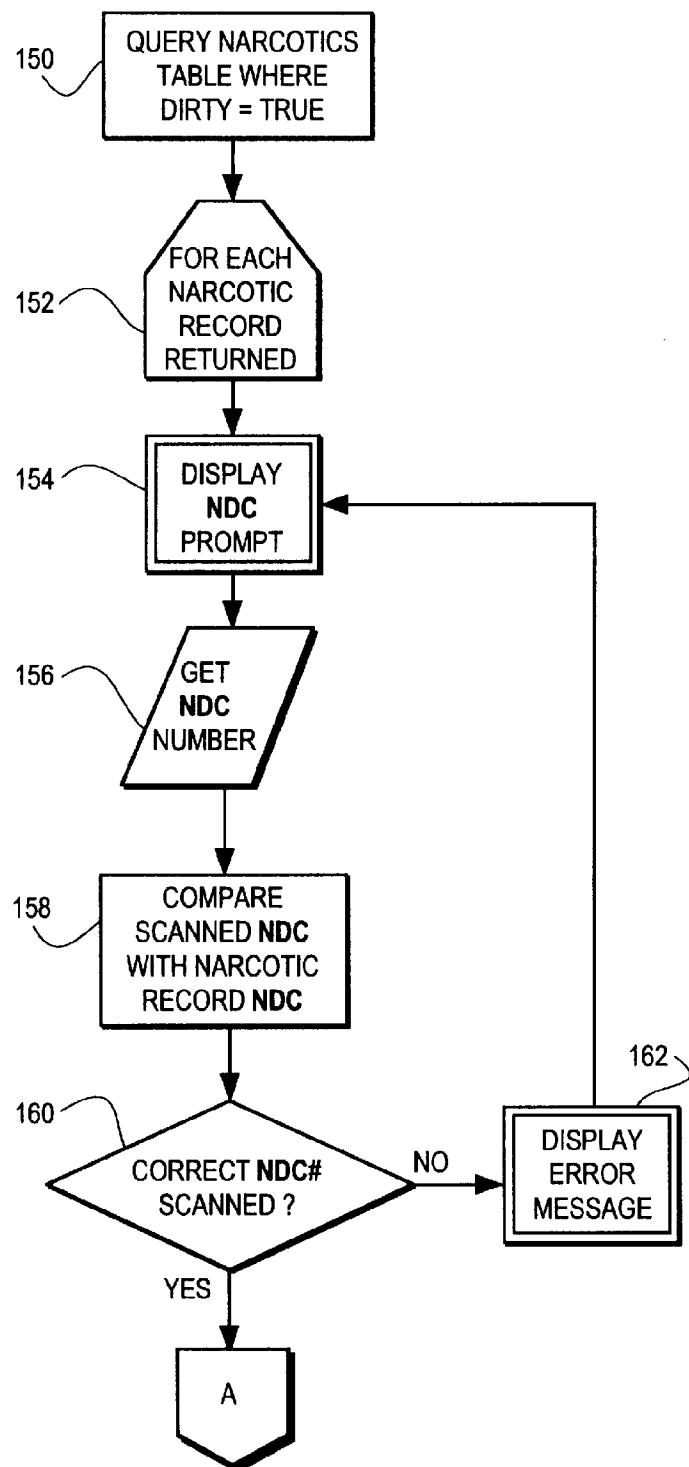


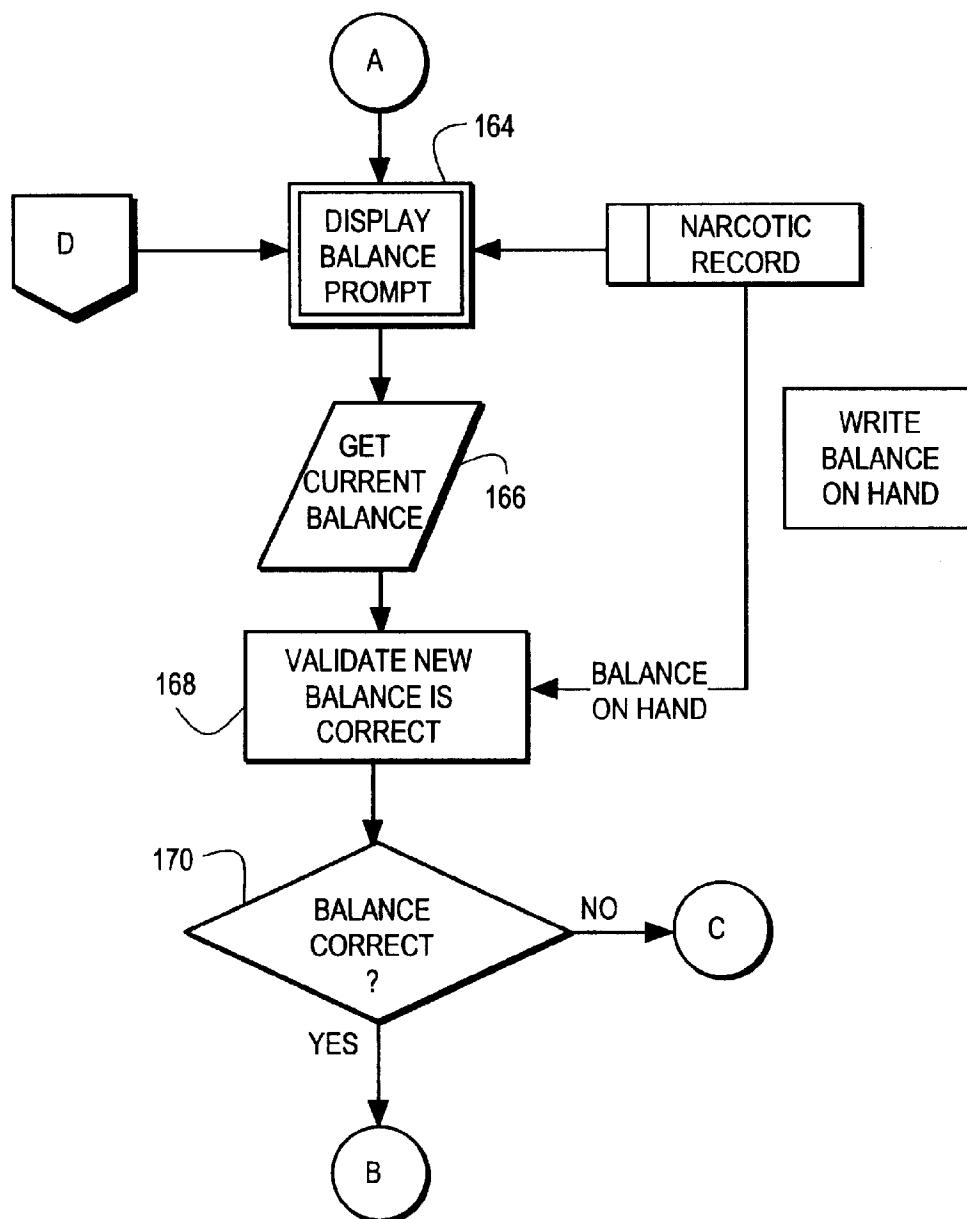
FIG. 7B

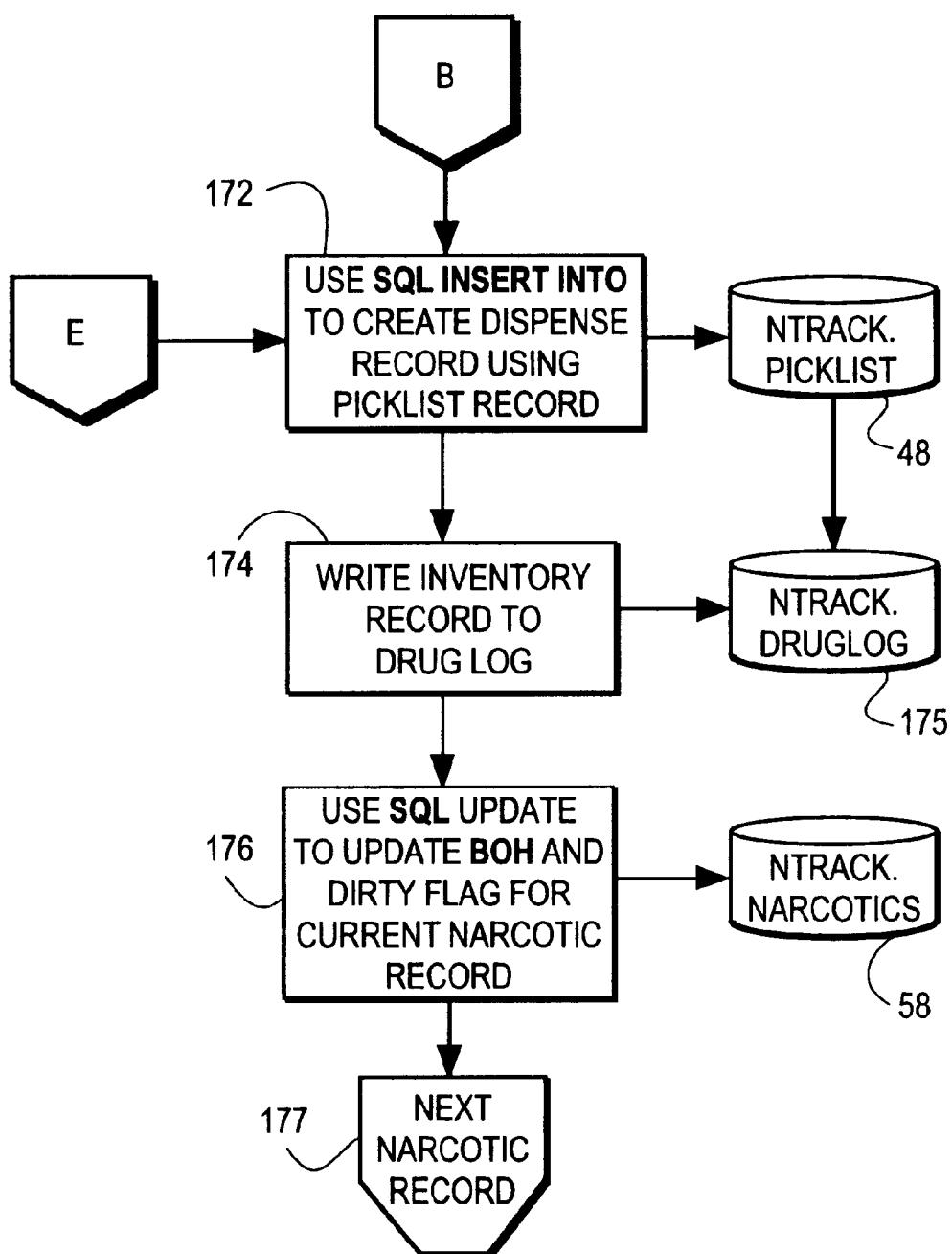
FIG. 7C

FIG. 7D

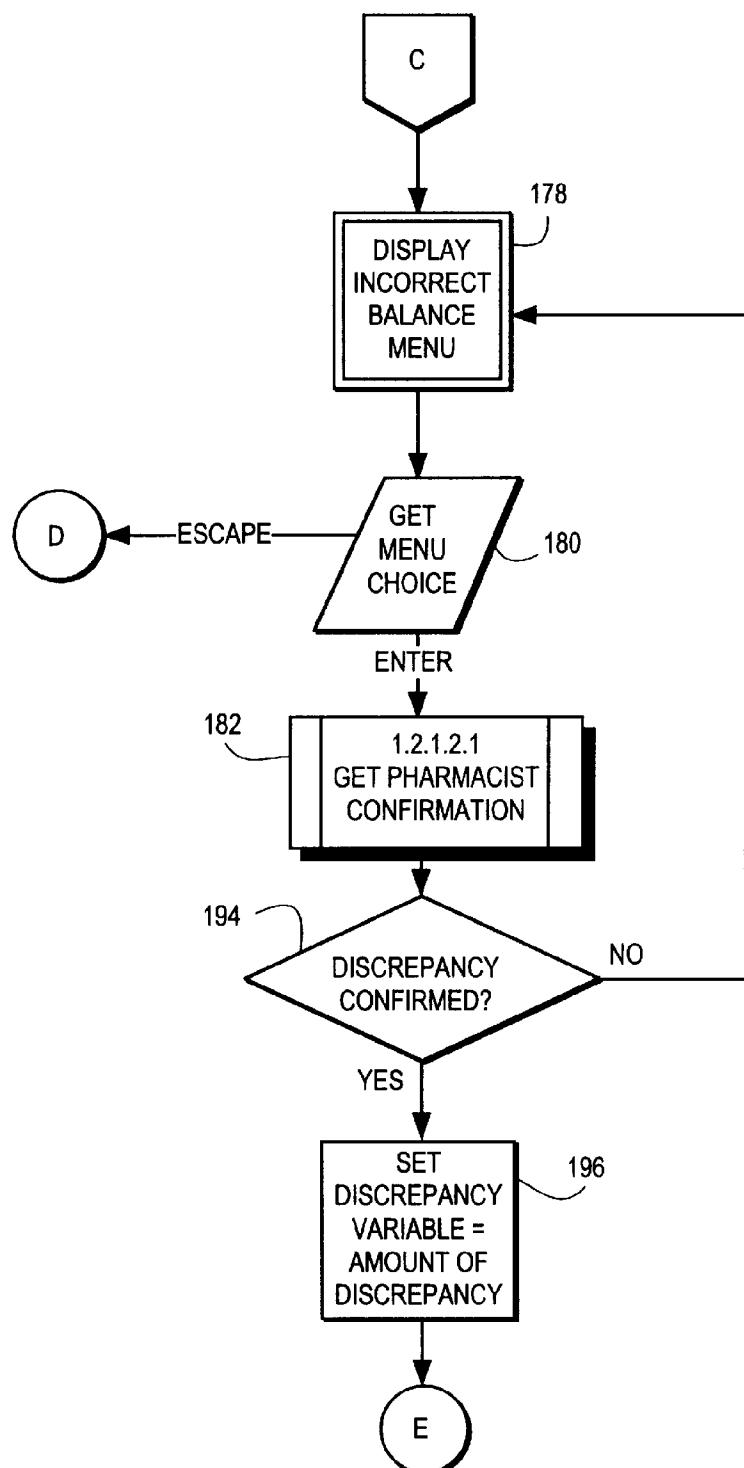


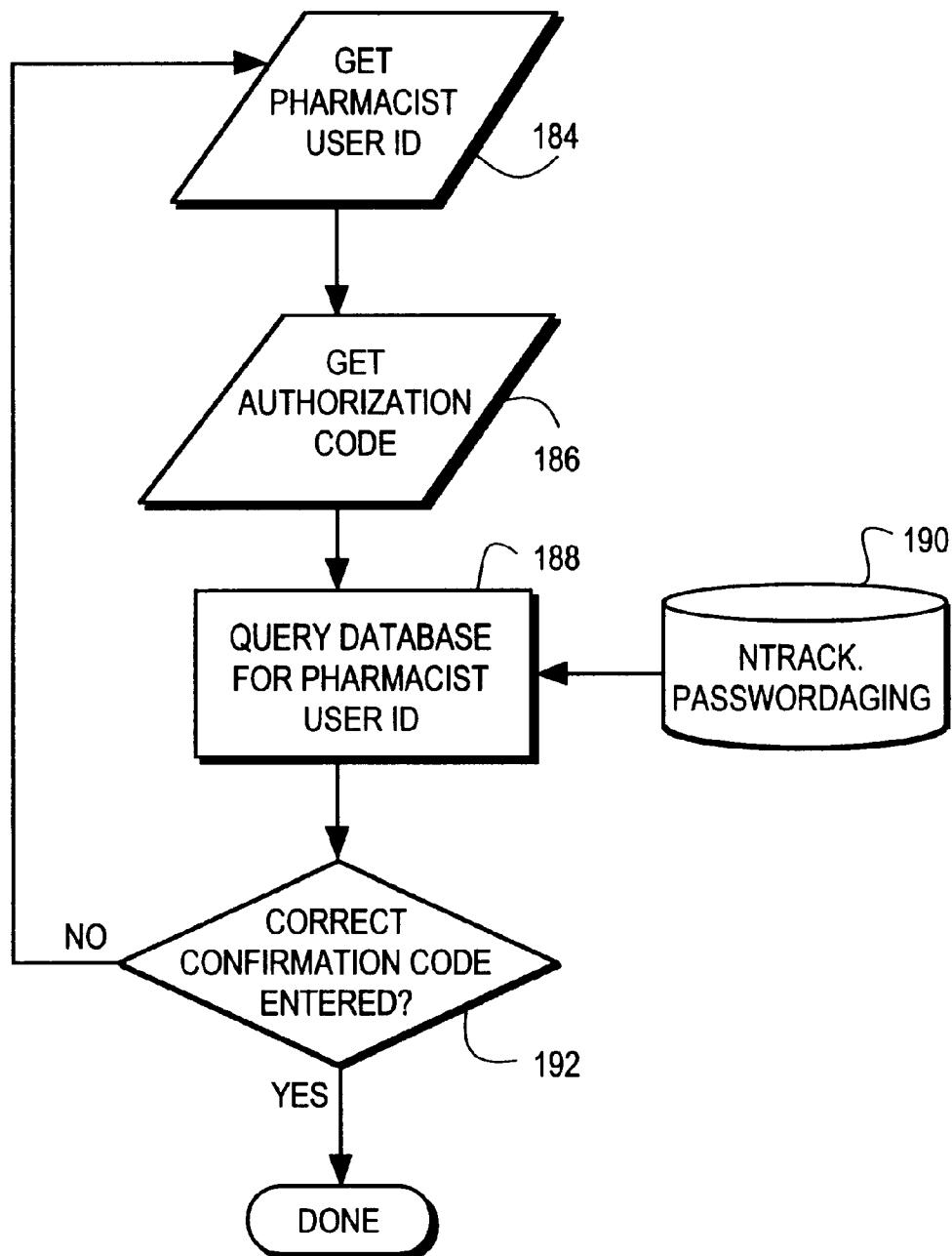
FIG. 8

FIG. 9A

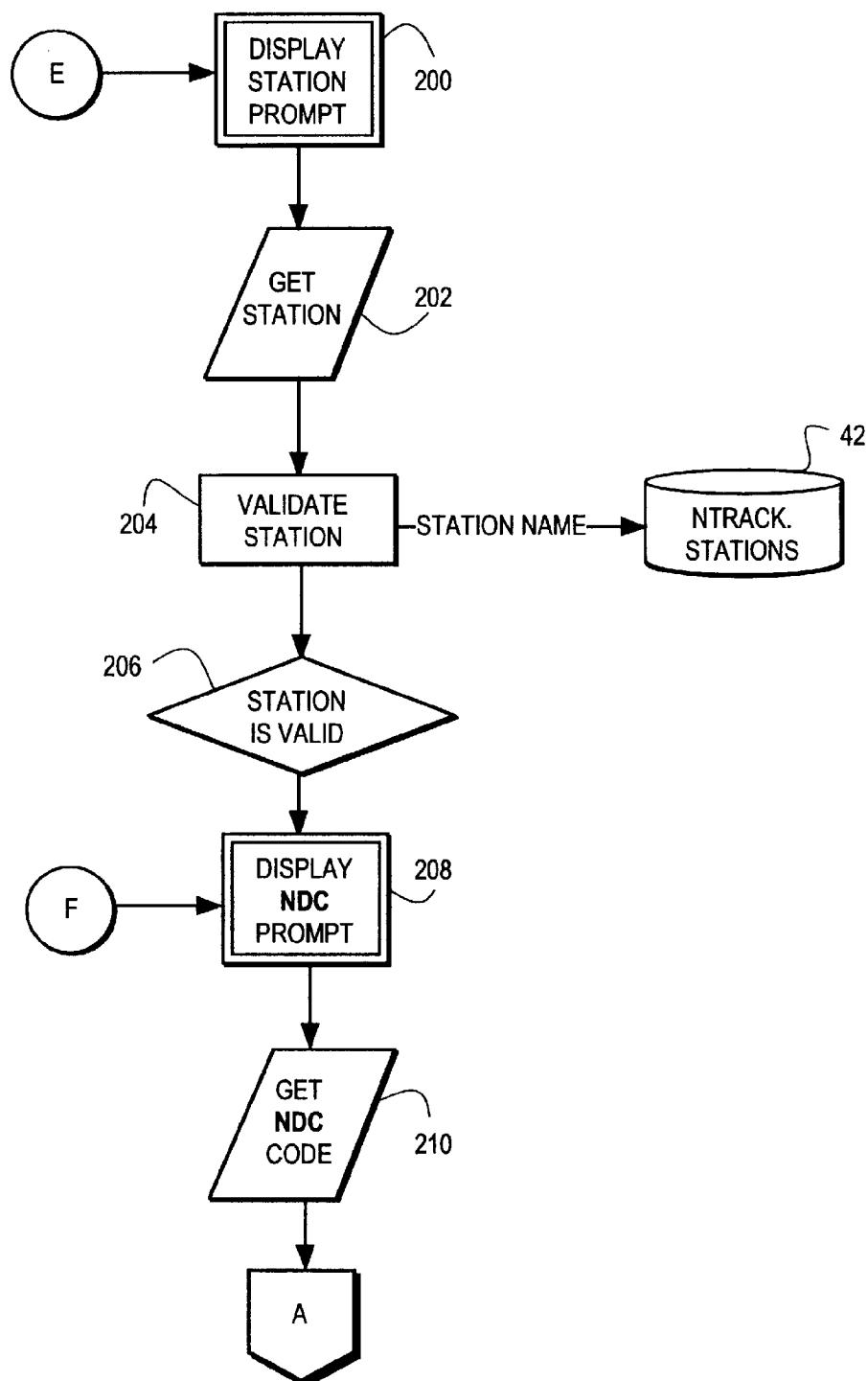


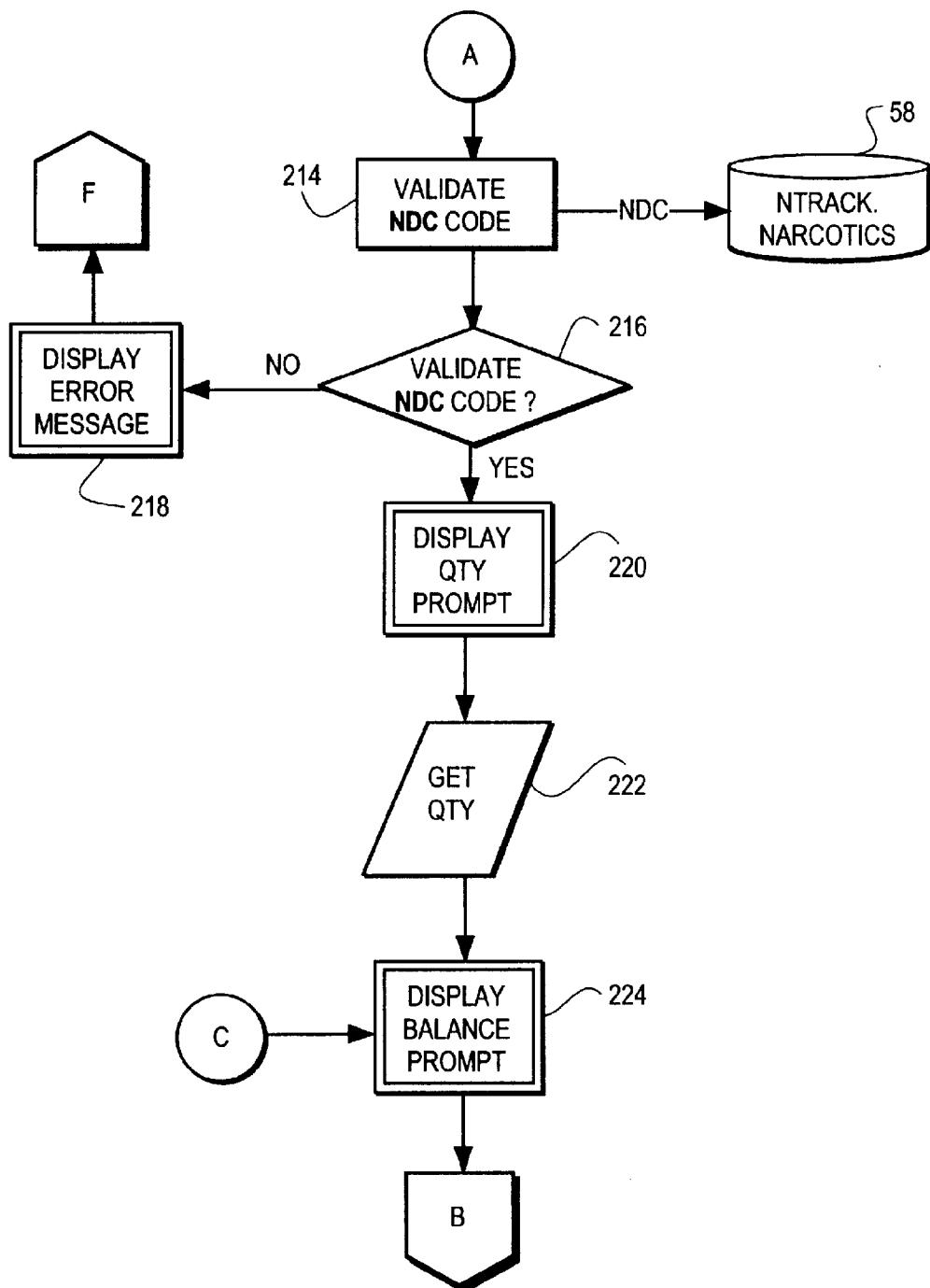
FIG. 9B

FIG. 9C

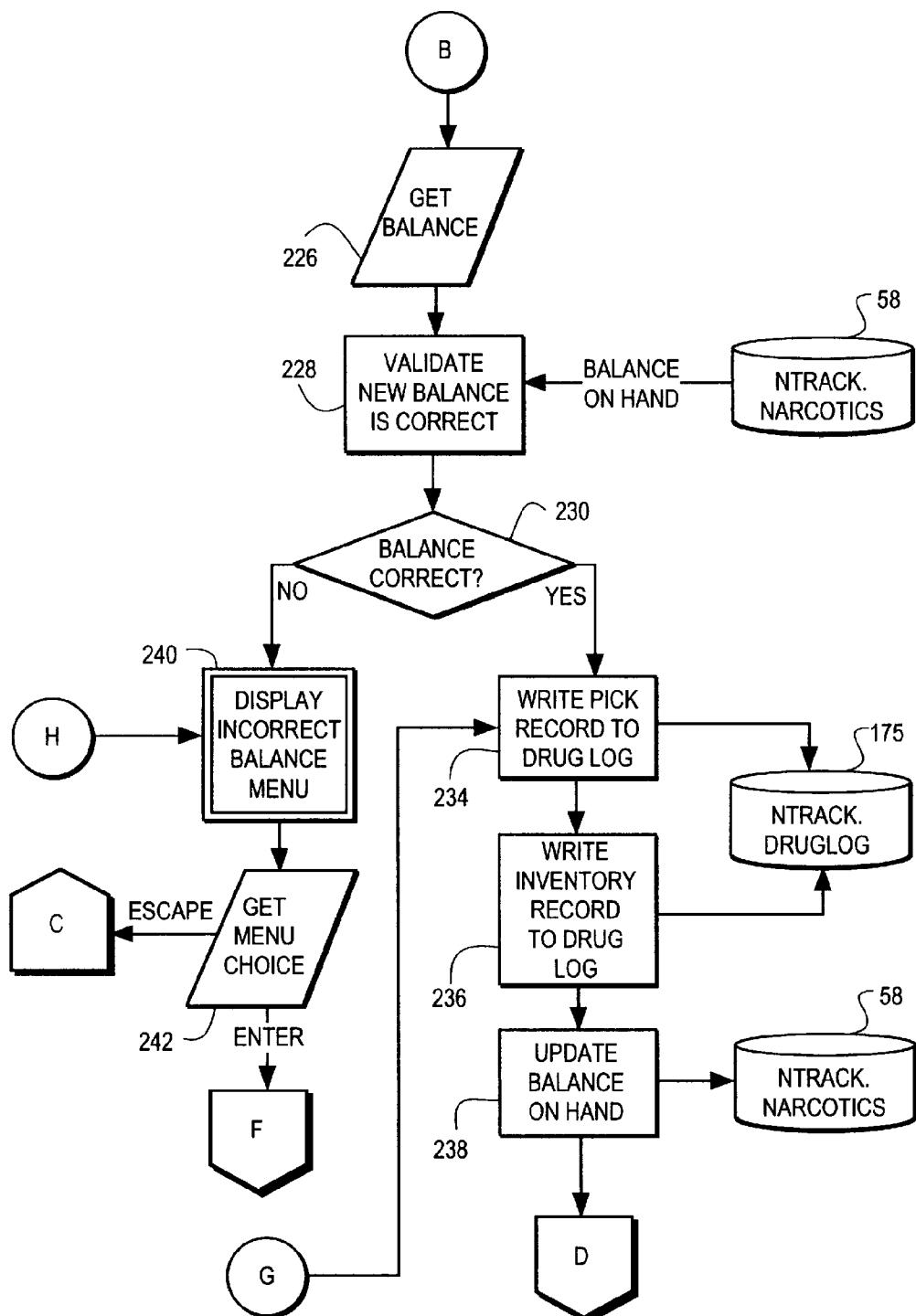


FIG. 9D

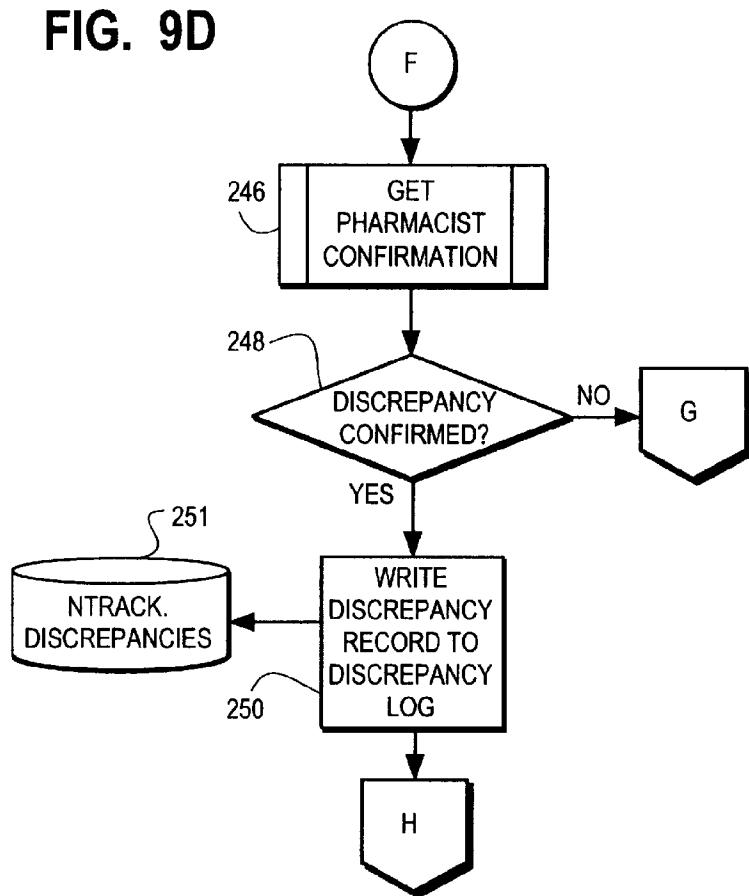


FIG. 9E

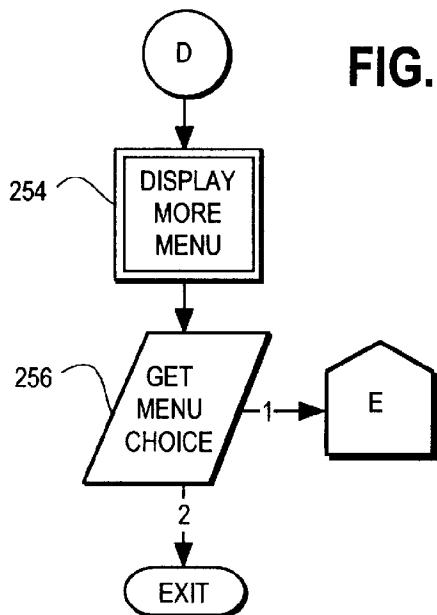


FIG. 10A

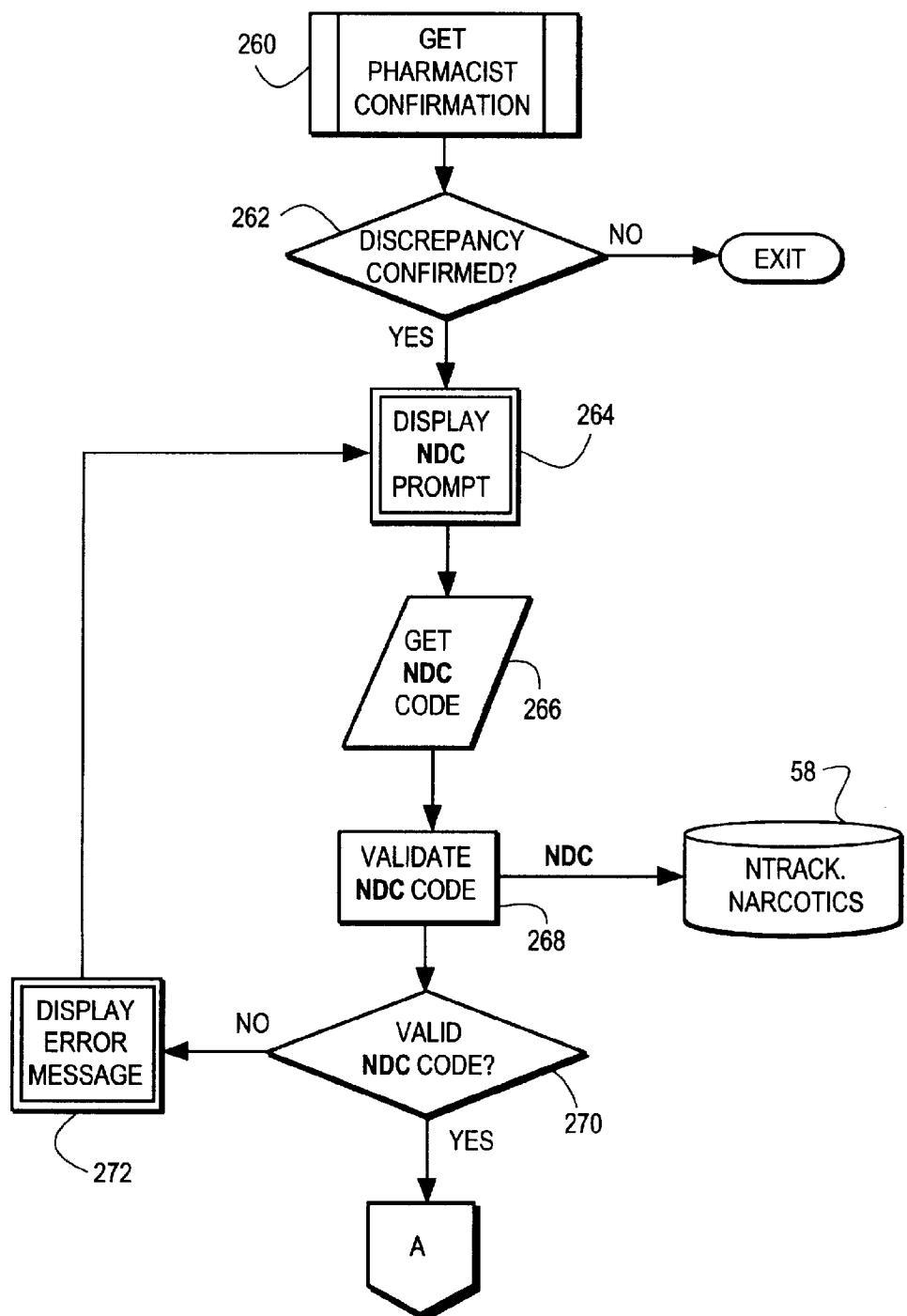


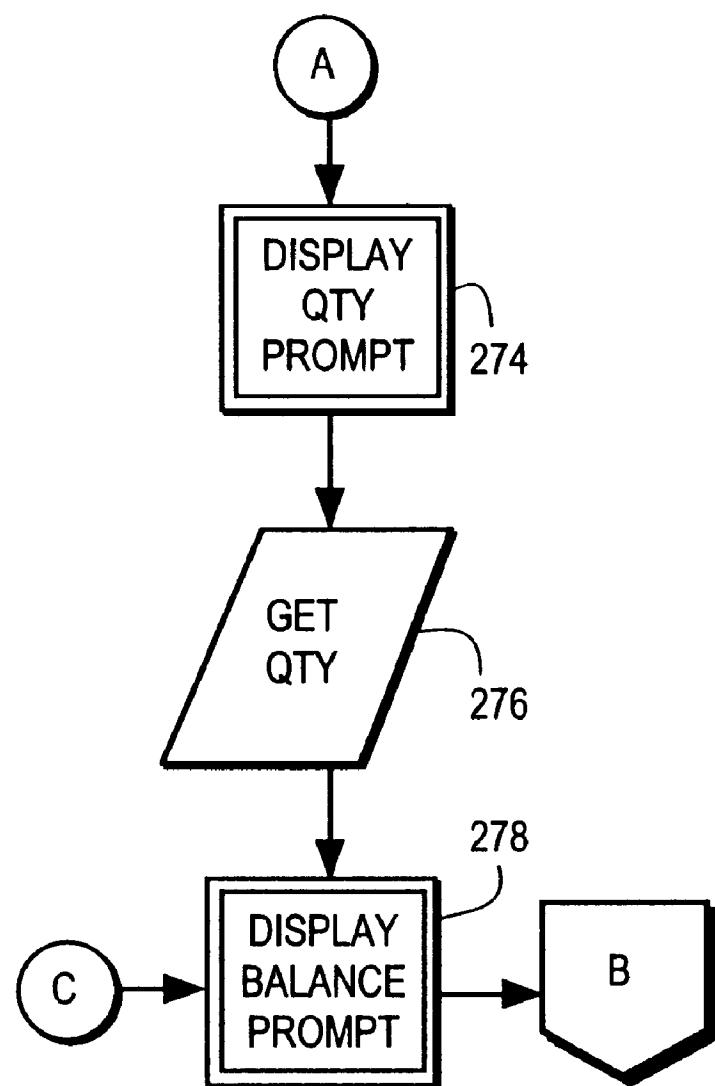
FIG. 10B

FIG. 10C

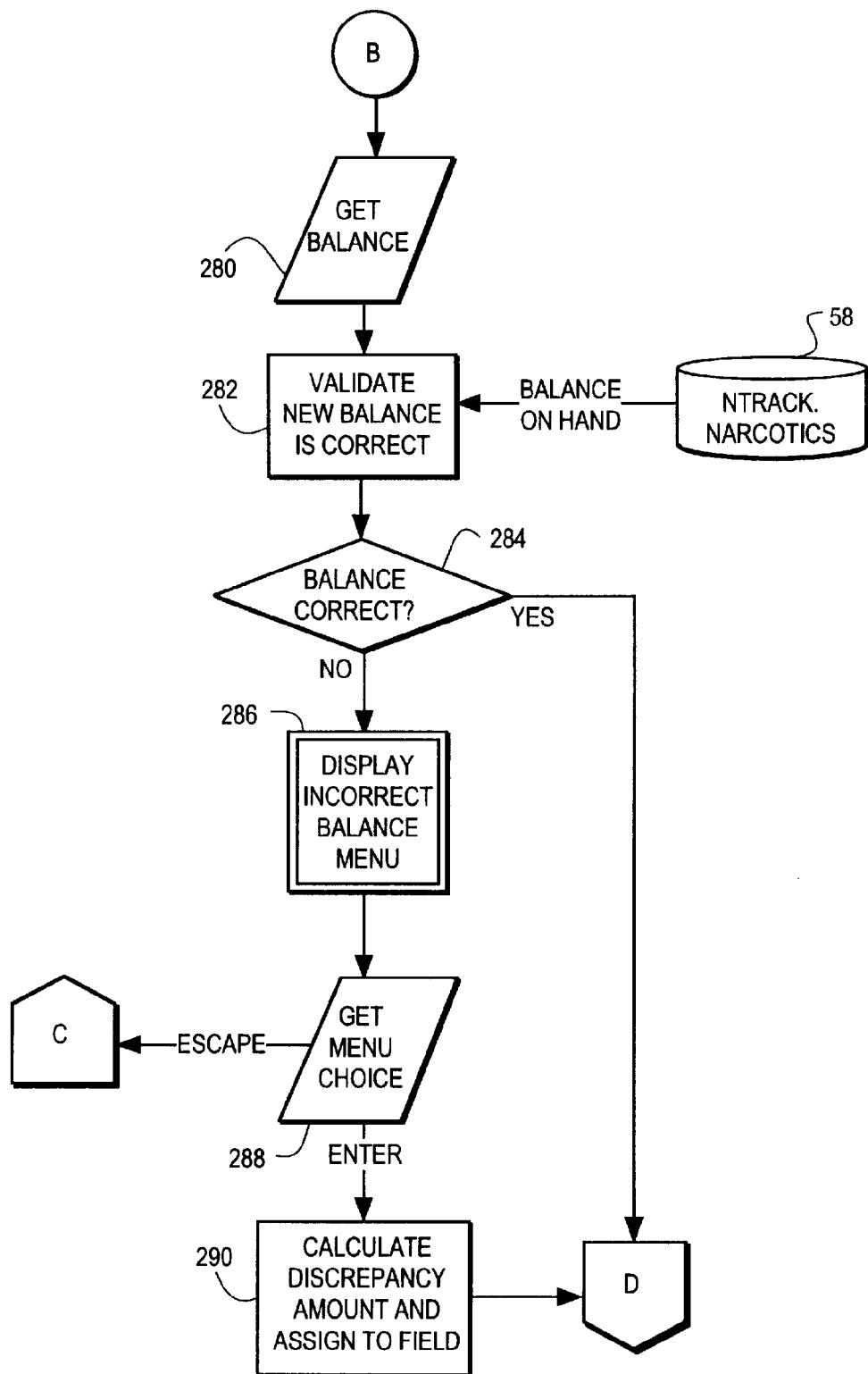


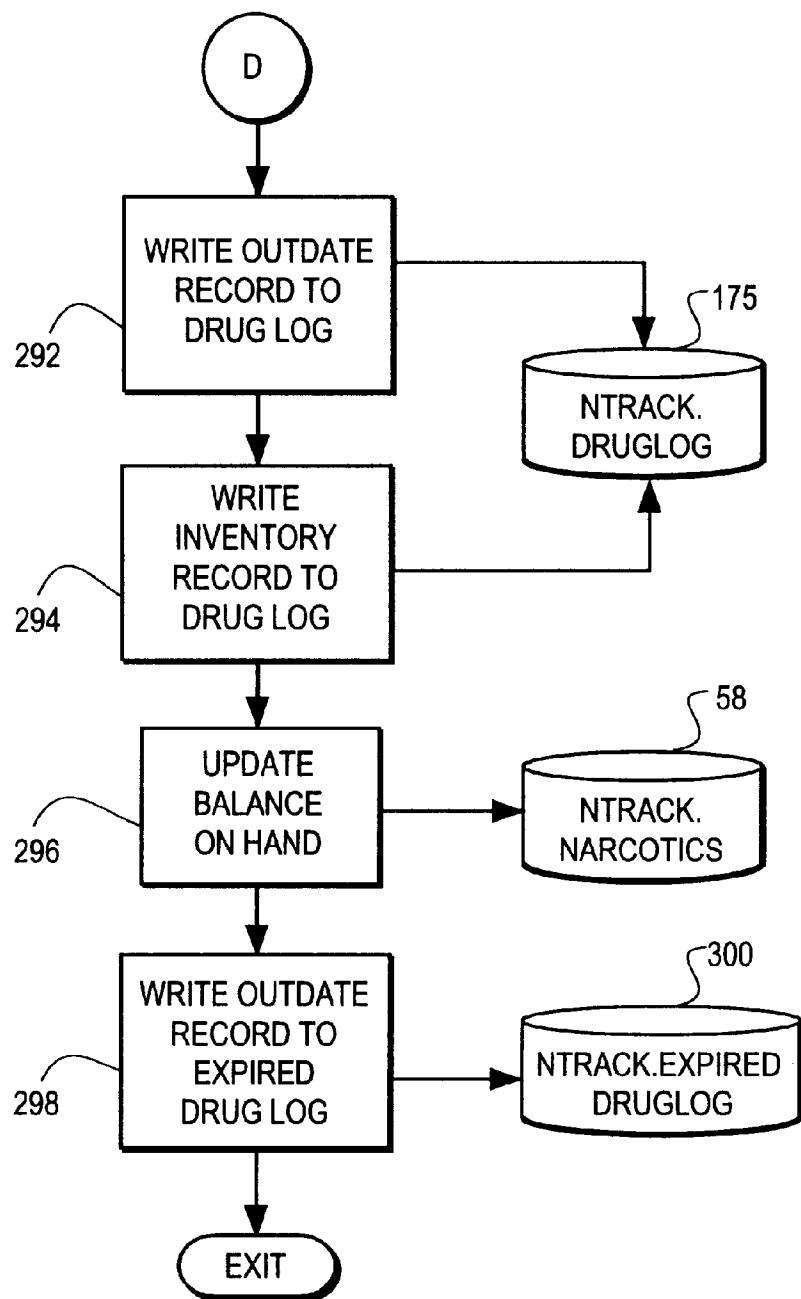
FIG. 10D

FIG. 11A

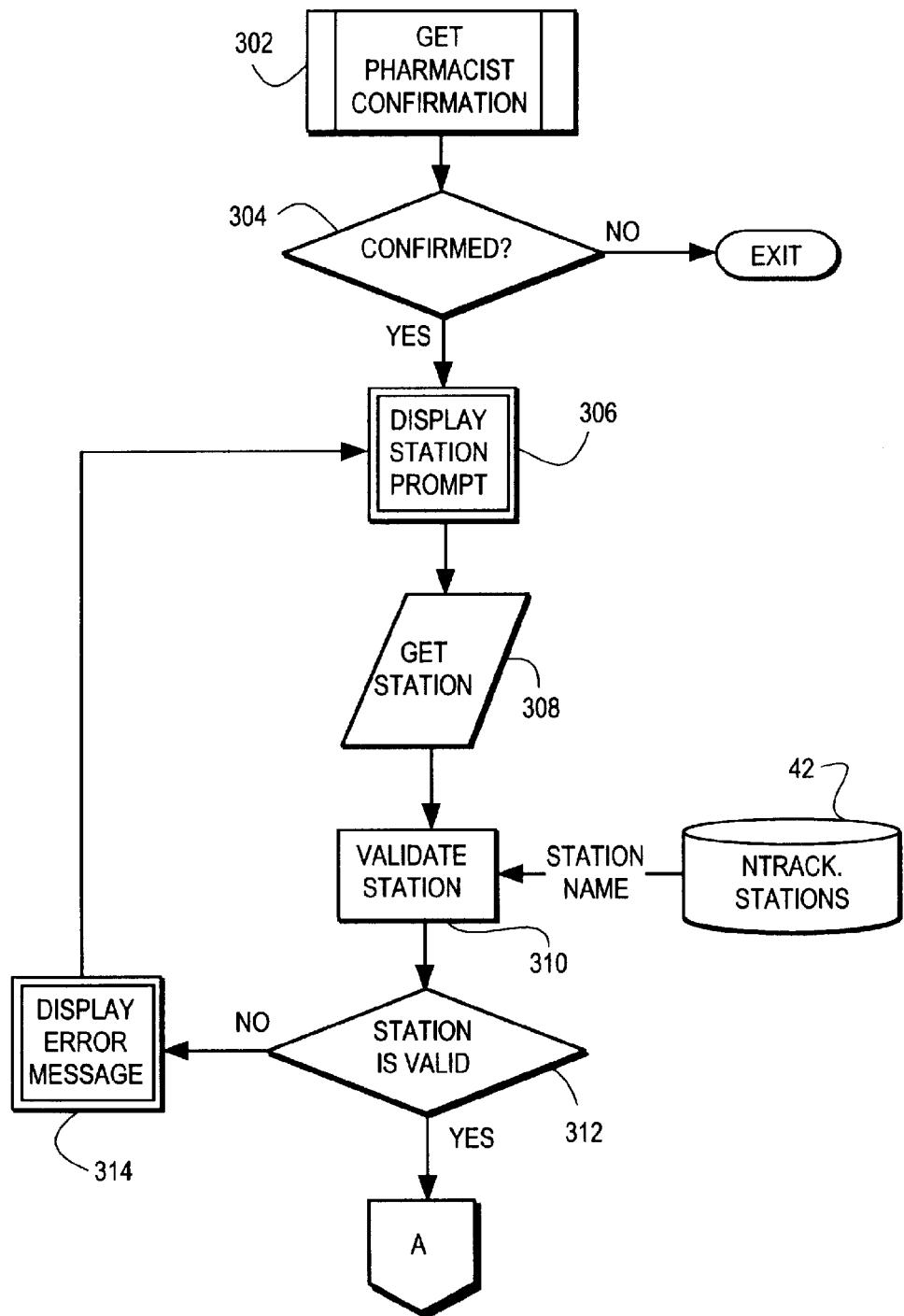


FIG. 11B

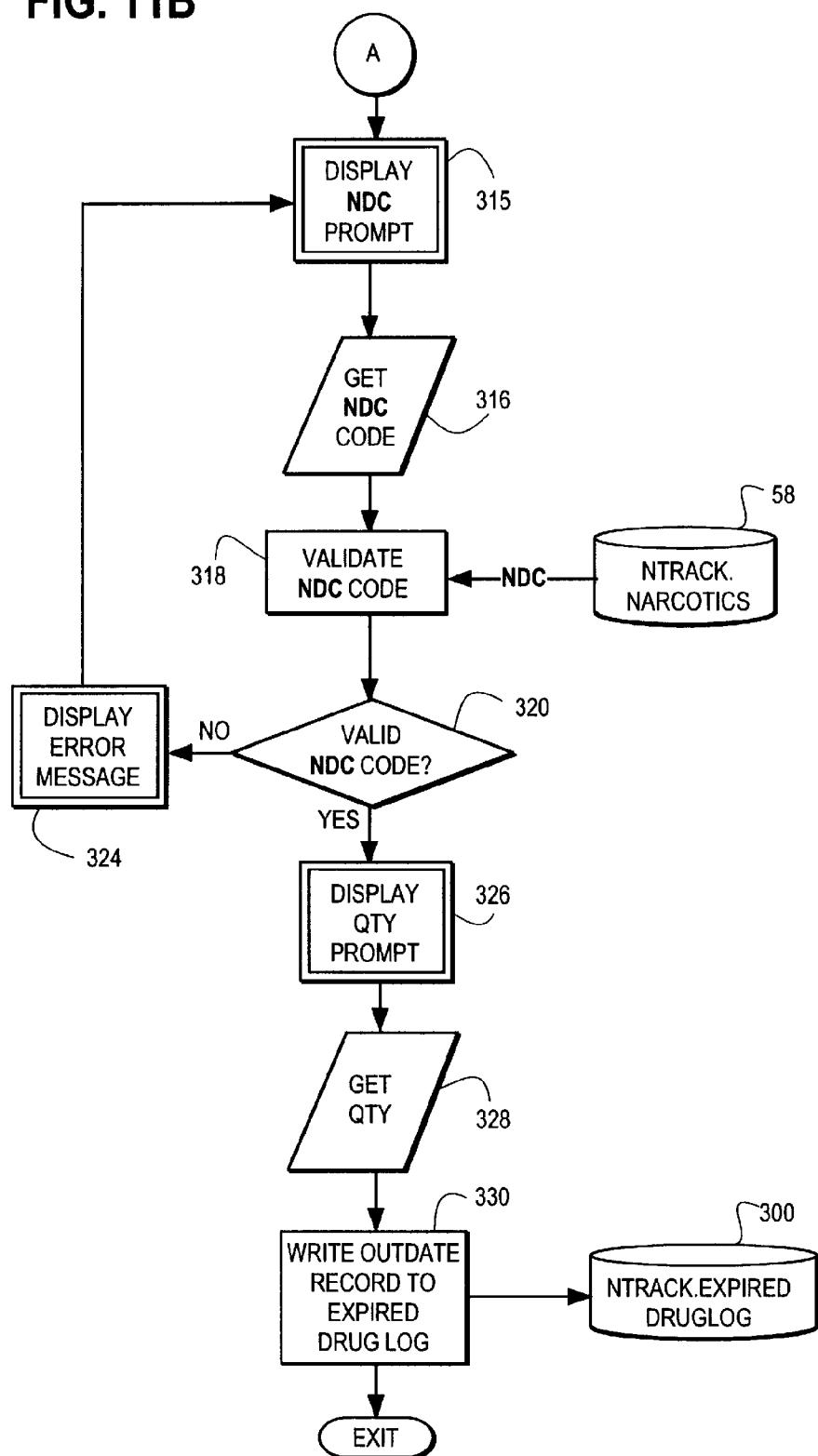


FIG. 12A

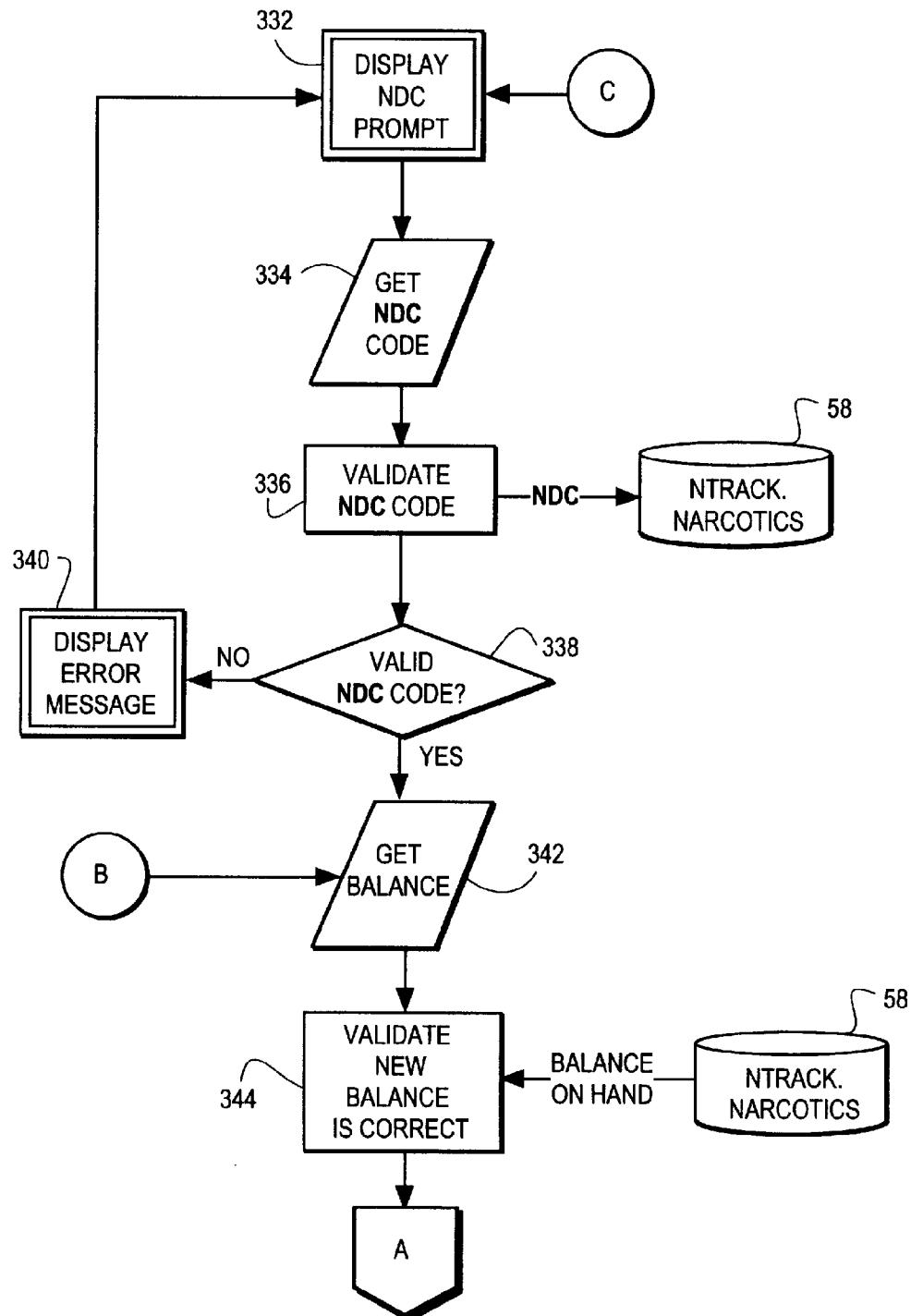


FIG. 12B

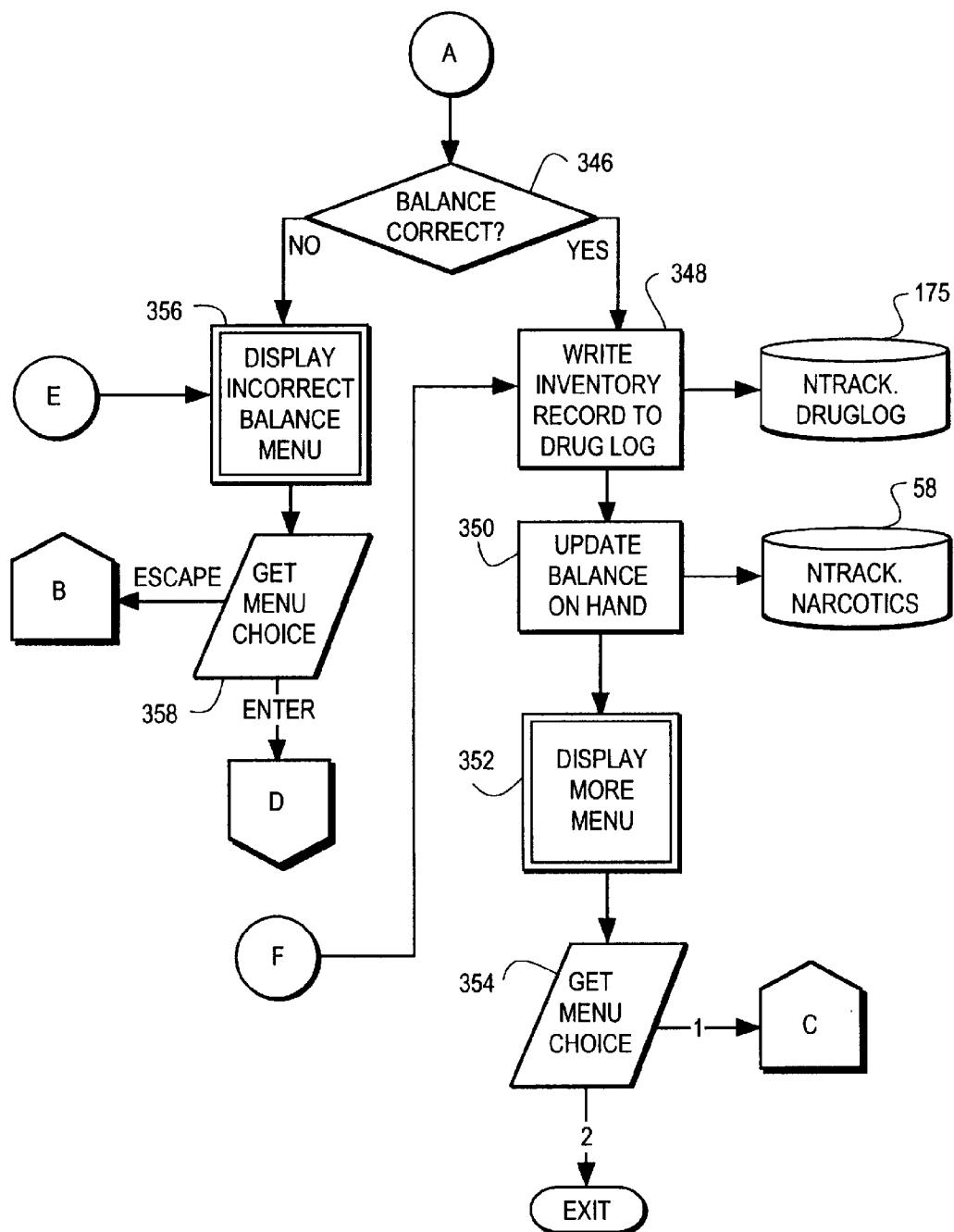
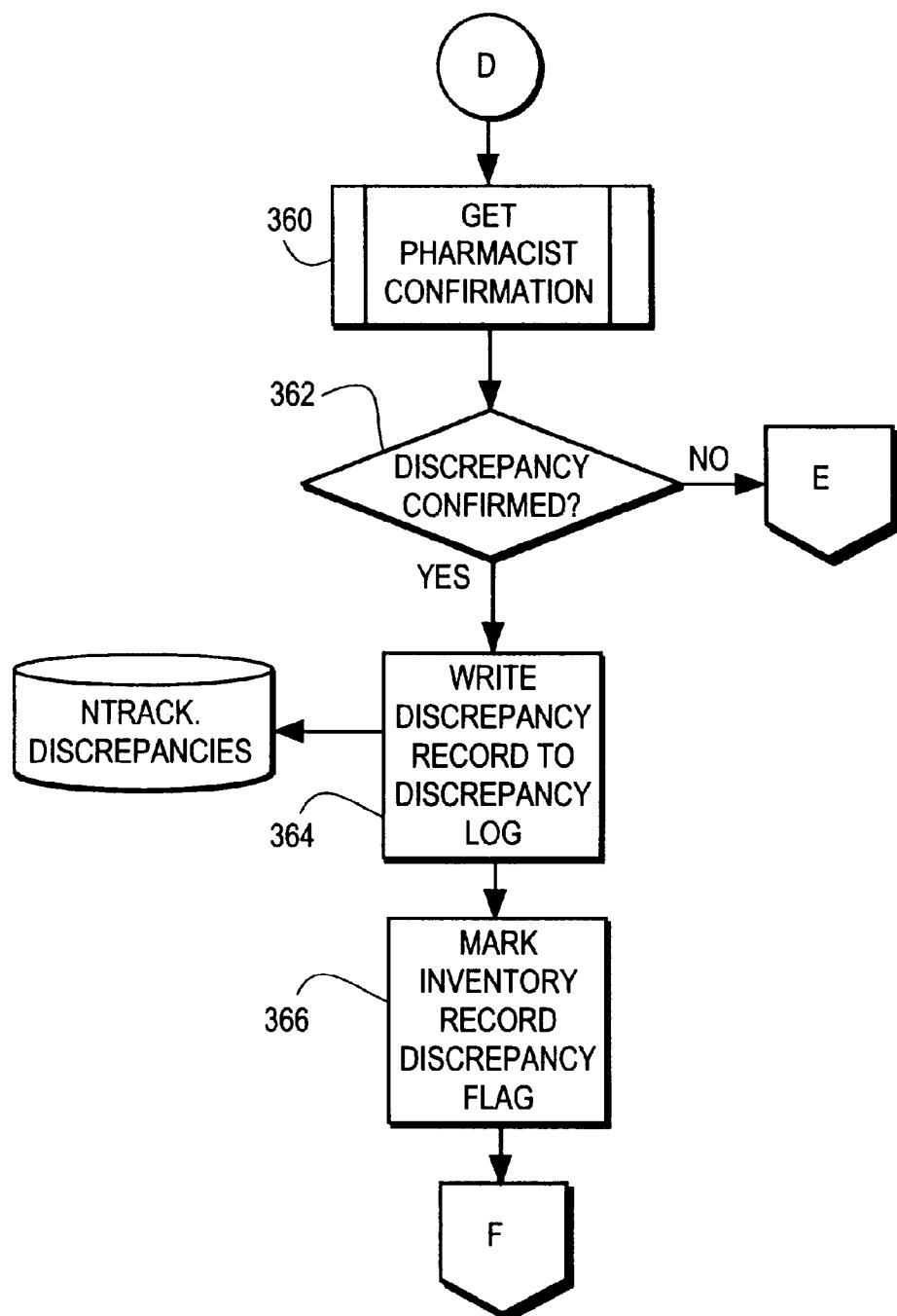


FIG. 12C



**SYSTEM AND METHOD FOR TRACKING
DRUGS IN A HOSPITAL**

TECHNICAL FIELD

The present invention relates to a drug tracking system and method for use in hospitals, pharmacies, etc. for tracking drugs including narcotics; and more particularly to such a system and method using a portable barcode scanning and printing system to reduce errors in the tracking information, to facilitate the ease and efficiency of tracking and to ensure reproducibility and security.

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

N/A

**STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH OR DEVELOPMENT**

N/A

BACKGROUND OF THE INVENTION

Known methods for tracking drugs, particularly narcotics, in hospitals or the like have been manual. The narcotics are typically located in a narcotics safe. The removal of drugs from the drug safe for distribution to nursing stations while tracking the removal is a very time intensive procedure prone to inaccuracies, as is the tracking of the addition of drugs to the narcotics safe. Typical manual tracking procedures are as follows.

In order to distribute the drugs from the safe to the nursing stations, a "pick-list" is first manually generated. A hospital technician gathers drug disposition records and 24 hour nursing audit records from each nursing station. Based upon these records, the technician determines the quantity of each drug at a nursing station and then determines whether that quantity of the drug is below a par level for that particular nursing station. If the final count of a drug is below the par level, an entry is manually made on a pick-list for that nursing station including information identifying the nursing station, the drug name and its strength, and the quantity required to bring the nursing station up to par level for the particular drug. Once all of the disposition records for all of the nursing stations have been processed in this manner, the technician takes the pick-list to the drug safe.

The technician gathers the required quantity of each drug listed on the pick-list for a particular station, one drug at a time. If the required quantity of a drug is contained in a box, the technician writes the nursing station and current date on the box. Otherwise, the drugs are placed in a resealable bag and the nursing station and date are handwritten on a label and the label affixed to the bag. The drug is then checked off from the pick-list for that particular nursing station. When all of the drugs for a nursing station have been picked, the drugs are bundled together with a rubber band and placed aside while the technician picks the drugs for the remaining nursing stations.

When the drugs have been picked for all of the nursing stations, the technician then fills out a Stock Replacement Work Sheet which consists of a large grid with rows representing each nursing station and columns representing each drug that is tracked. For each nursing station on the pick-list and for each drug required for that particular nursing station, the quantity of the drug picked or removed from the safe is recorded in the grid cell in association with the particular nursing station and drug. Then for each drug

5 on the Stock Replacement Work Sheet, the technician adds the entries for the drug and places a total in the last row in association with the drug column. The Stock Replacement Work Sheet is then used to update the Drug Logs for each drug that was picked.

In accordance with government regulations, each drug has an individual Drug Log that records each transaction that occurs involving the drug. In order to update the Drug Logs for each drug that was picked, the log for the particular drug must be manually retrieved and the following information entered: the current date, the total amount picked as indicated on the Stock Replacement Work Sheet, the technician's initials, a code representing the destination of the drug, and a new balance which is calculated by taking the last balance of the drug and subtracting the amount picked.

10 Thereafter, a physical inventory of the drug is performed whereby the technician counts the quantity of the drug remaining in the safe. The technician then compares the counted quantity remaining to a balance recorded in the Drug Log for the particular drug. If there is a discrepancy, the technician must find the cause of the discrepancy, i.e. 15 math or entry error and correct it. If the technician cannot determine the cause of the discrepancy, a discrepancy report is filed. It is also not uncommon for drugs to be picked from the safe at irregular intervals before or after the picking process occurs. In these situations, because of the typical 20 urgency to deliver the drug to its intended destination, the Drug Log may not be accurately updated resulting in discrepancies.

25 When drugs are to be added to the drug safe from a wholesaler or are returned from a nursing station, they must also be recorded on the drug logs. For each drug received, the drug is counted and the Log for the drug is obtained. The technician then manually records the current date, the total amount of the drug counted as being received, the technician's initials, the source of the drugs i.e., the identity of the 30 nursing station or the wholesaler, and a new balance which is calculated by taking the last balance of the drug and adding the amount received. A physical inventory of the drug is then performed. The technician then compares the recorded balance on the Drug Log to the balance resulting from the physical inventory of the drugs. Again, if a discrepancy is found, the technician must find the cause of the 35 discrepancy and correct it or file a discrepancy report.

40 Each month, the drugs in the safe are also examined to locate any that have passed their expiration date. Outdated drugs are removed from the area in the safe from which the drugs are dispensed to nursing stations and are placed in a separate location in the safe until they are disposed of. For 45 each outdated drug that is removed to the separate disposal location in the safe, the Log for the drug is pulled and the following information recorded: the current date, the quantity of the drug being outdated, the technician's initials, a code representing the destination, i.e. the outdate location within the safe or a destruction location and a new balance 50 which is calculated by taking the last balance of the drug and subtracting the amount being outdated. A physical inventory of the drug is then performed as discussed above with discrepancies either being corrected or being accounted for by the filing of a discrepancy report. An entry is also 55 manually made in a Discarded Meds Drug Log for outdated drugs. This Log tracks the outdated drugs until they are disposed of and contains the same information as the regular Drug Logs. The manual entry of the required information by handwriting the entries or even by manually entering the 60 information into a computer is expensive, labor intensive and is prone to inaccuracies requiring many hours to resolve and to report the discrepancies.

Automatic systems for dispensing drugs are known such as described in U.S. Pat. No. 5,762,235. However, these systems do not track the location of the drug.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, the disadvantages of prior methods for tracking drugs as discussed above have been overcome. The system and method of the present invention utilize a portable scanning and printing system for tracking drugs maintained at a location so as to minimize the manual entry of tracking data and automatically update the requisite records to improve the accuracy, speed and efficiency of the drug tracking.

More particularly, the portable scanning and printing system includes a memory for collecting data, a display, a printer and a number of input means including a barcode scanner, a keyboard or keypad, and a wireless communication interface. The wireless communication interface allows the portable scanning and printing system to communicate with a host system having a memory for storing drug tracking records wherein the host system automatically updates the drug tracking records from information transmitted thereto by the portable scanning and printing system.

The portable scanning and printing system is operated in accordance with the method of the present invention so as to receive user identification information from one of the input means; to receive from the scanner, scanned barcode data representing the identity of a drug maintained at the location; and to receive from the keyboard data confirming a quantity of a drug being added to or removed from the location. The portable scanning and printing system associates the data entered from the various input means and automatically transmits to the host system via the communication interface selective, associated information regarding the addition of the drug or the removal of the drug from the location so that the records at the host can be automatically updated. The information includes the user's identification, the destination or source, the identity of the drug and the quantity of the drug being added or removed. Any labels that are required are printed by the portable scanning and printing system from the information entered from the various input means during the drug tracking operation without the necessity to re-enter any data. The portable scanning and printing system automatically selects which associated information is to be printed and prints the labels at the location where they are needed. This operation of the portable scanning and printing system for tracking drugs maintained at a location drastically improves the speed and accuracy of tracking drugs.

In accordance with another feature of the present invention, the portable scanning and printing system is operated to receive from the keyboard, data representing a quantity of the drug that the user counts as remaining at the location, i.e. a user entered balance. The portable scanning and printing system verifies the user entered balance by wireless communication with the host system and the use of the host system's records. In particular, the user entered balance is compared to the balance data for the drug maintained in the host's stored drug tracking records. This comparison may be done by the portable scanning and printing system upon receipt of information representing a balance stored in the host's records or upon the updating of balance data stored in the portable system's memory. Alternatively, the comparison can be made by the host system in which case the host transmits the results of the comparison to the portable scanning and printing system

which thereafter uses the results to verify the balance. The user entered balance is verified if the comparison results in a determination that the user entered balance matches the balance maintained in the host's records. If the user entered balance is not verified, the portable scanning and printing system allows the user to re-enter the counted quantity so that any counting errors can be immediately corrected. Alternatively, if a discrepancy is confirmed, the portable scanning and printing system determines the amount of the discrepancy and a discrepancy record is automatically transmitted to the host system.

In accordance with another feature of the present invention, the portable scanning and printing system automatically prompts the user to pick drugs identified by pick-list information received from the host system. After prompting the user to pick a particular drug, by displaying information identifying the drug to be picked for a particular destination, the user scans a barcode associated with the identified drug, the barcode typically being located on the shelf supporting the drug, or on a drug container. Upon receiving a scanned barcode representing the identity of a drug, the portable scanning and printing system compares the identity of the drug represented by the scanned barcode data to the identity of the drug received from the host system. If there is no match, an error message will be displayed for the user so as to advise the user that the wrong drug was scanned. By prompting the user for a particular drug and automatically verifying whether the user entered drug identity matches the drug that the system has prompted the user to pick, the present invention insures that the correct drugs are picked and that all of the drugs identified on the pick-list for a particular nursing station are picked so as to increase the accuracy, speed and efficiency of the operation.

The system and method of the present invention can be utilized to track drugs removed from a location with a pick-list or without a pick-list, to track drugs received at a location, to outdate drugs and to inventory drugs accurately and efficiently. These and other advantages and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a block diagram of the system of the present invention including a portable scanning and printing system for tracking drugs maintained at a location and a host system to which the portable system communicates;

FIG. 2 is a block diagram of one embodiment of the portable scanning and printing system for tracking drugs as illustrated in FIG. 1;

FIGS. 3A, 3B and 3C form a flow chart illustrating the operation of the host processing system in generating a pick-list;

FIG. 4 is a flow chart illustrating various operations of the portable scanning and printing system for tracking drugs;

FIG. 5 is a flow chart illustrating a user login operation of the portable scanning and printing system;

FIGS. 6A, 6B and 6C form a flow chart illustrating the operation of the portable scanning and printing system when drugs are picked from a pick-list;

FIGS. 7A, 7B, 7C and 7D form a flow chart illustrating an inventory operation of the portable scanning and printing system for drugs picked from a pick-list;

FIG. 8 is a flow chart illustrating an operation of the portable scanning and printing system in obtaining pharmacist confirmation;

FIGS. 9A, 9B, 9C, 9D and 9E form a flow chart illustrating an operation of the portable scanning and printing system for picking drugs not on a pick list and for receiving drugs;

FIGS. 10, 10B, 10C and 10D illustrate an operation of the portable scanning and printing system for performing an outdated operation for inventoried drugs;

FIGS. 11A and 11B form a flow chart illustrating an operation of the portable scanning and printing system for outdated drugs that are not inventoried; and

FIGS. 12A, 12B and 12C form a flow chart illustrating an operation of the portable scanning and printing system for providing an inventory of drugs maintained at a location.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates a system for tracking drugs, including narcotics, at hospitals, clinics, pharmacies, etc. The system includes a P.C. based server 10 having a personal computer (P.C.) 12 or the like with associated memory 13, a display 14, a keyboard 15 and/or mouse. The P.C. 12 is coupled to a local area network (LAN) 18 that includes the capability of wireless communication. One example of a suitable local area network 18 is a token ring although other types of LANs can be used as well. A radio frequency access point 19 on the local area network allows the P.C. based server 10 to communicate i.e. transmit and receive, wireless communications with the portable barcode scanning and printing system 20. Whereas, the P.C. based server 10 with wireless communication capability forming a host system maintains drug tracking records in its associated memory, the portable barcode scanning and printing system 20 allows drug tracking data to be collected, verified and recorded with minimal input from the user so as to increase the speed and accuracy of the drug tracking operation.

The portable scanning and printing system 20 in accordance with one embodiment of the present invention as shown in FIGS. 1 and 2 is a hand-held integrated unit. Because it is portable, the user can track a drug and print barcoded labels therefrom at the drug's location on a shelf in the safe without moving to other locations to obtain Drug Logs or to use fixed location data entry and printing terminals. Because movement of the user away from the drug's shelf location is eliminated, numerous errors in the tracking process are eliminated and the accuracy and efficiency of the operation greatly increases.

The portable scanning and printing system 20 includes a number of input means for entering data into the system 20 including a barcode scanner 22, a keyboard 24 and a radio frequency communication interface 26. The barcode scanner 22 is operated to scan a barcode containing National Drug Code (NDC) information that identifies a drug, i.e. the drug's name and its strength. The keypad or keyboard 24 is used to enter alpha-numeric information into the system 20. The keyboard 24 can include a large number of keys or it can include a minimal number of keys one of which is used as a cursor or the like. The radio frequency (R.F.) communication interface 26 with associated antenna 27 includes a receiver and transmitter or transceiver to allow two-way communications between the portable scanning and printing system 20 and the host system 10 as discussed in detail below.

The portable scanning and printing system 20 includes a display 28 that is controlled to display prompts to the user to enter particular information so as to lead the user through a drug tracking operation in order to prevent the user from

forgetting to enter information that is necessary to track a drug. The portable scanning and printing device 20 also includes a barcode printer 30 that is preferably a label printer. In the embodiment shown in FIG. 1, the printer portion 30 of the portable scanning and printing system 20 is a labeler that includes a label applicator 31 for applying labels 29 after they have been printed. The portable scanning and printing system 20 includes a processing unit 32 with one or more microprocessors for controlling the various input and output devices and for controlling the collection of data in the memory 34. In particular, the processing unit 32 collects data in the memory 34 by selectively associating input information received from two or more of the input means 22, 24 and 26. Such selective association of data in the memory 34 allows the processing unit to transmit and/or print selected portions of the associated data. Therefore, the portable scanning and printing system is an intelligent system and not merely an input and/or output device for the host system 10. In the preferred embodiment, the portable scanning and printing device has a handle 36 and a trigger 38 mounted on the handle so as to actuate the barcode scanner 22 and/or printer portion 30 of the system 20 in accordance with the software of the processing unit 32. In this embodiment, the barcode scanner 22 and printer 30 are contained within a housing 39 forming a single integrated unit that is portable. Details of a portable scanning and printing system such as described above are found in U.S. Pat. No. 5,483,624, entitled Programmable Hand Held Labeler, assigned to the assignee of the present invention and incorporated herein by reference. However, other configurations of the portable scanning and printing system 20 can be utilized in accordance with the present invention as well. For example, in another embodiment, a portable barcode scanner with data collection capabilities can be coupled via a hard wired connection to a portable or mobile printer. In another embodiment of the portable scanning and printing system 20 in accordance with the present invention, the portable scanner with data collection capabilities may communicate with a portable or mobile printer via RF communication. In still another embodiment, a scanner without data collection capabilities may be used with an intelligent printer capable of associating data received from the scanner portion, R.F. communication portion and the keyboard. Although the printer portion 30 of the portable scanning and printing system 20 need not necessarily be portable, in accordance with the present invention, a mobile printer is preferred since the mobility of the printer as well as the portability of the scanner allows the scanning and printing of labels to occur at the location of a particular drug in the drug safe. This feature allows the technician to complete the removal, addition and/or inventory of a single drug without the necessity of moving to another location within or outside of the safe before the tracking operation for that drug is completed. Thus, the efficiency as well as accuracy of the tracking system and method are greatly increased.

In accordance with the present invention, drugs may be picked i.e., removed from a location, based on a pick-list generated by the host system 10 or without the use of a pick-list as described in detail below. If a pick-list is to be used for the picking operation, a pick-list is generated by the P.C. 12 in accordance with the routine depicted in FIGS. 3A-3B. Upon entering the pick-list entry mode of operation, the P.C. 12 at a block 40 retrieves the various stations, in this example, nursing stations, from the Station records 42 stored in the P.C. server's memory and loads the retrieved stations into a selection box depicted on the display 14. The P.C. is responsive at block 43 to a user's selection of a station

depicted on the display 14 to retrieve, at block 44, the drugs assigned to the selected station from the Drug or Narcotics records 58 of the P.C. server's memory. At block 44 the P.C. 12 loads a pick list grid depicted on the display with the retrieved list of drugs for the selected station. At block 46, the P.C. 12 loads for each drug listed in the pick list grid the amount of the drug to be picked as indicated in the pick list records 48 previously stored for the station. Thereafter, the P.C. 12 proceeds to block 49 to determine whether new drugs are to be assigned to the station based on user selection of a displayed "Narcotics Button" at block 50. If so, the P.C. 12 proceeds to block 51 to execute the routine depicted in FIG. 3C.

Upon entering the routine of FIG. 3C, the P.C. 12 loads at block 52 a list of selectable narcotics retrieved from the narcotics records 58 into a "Narcotic Grid" depicted on the display 14. At block 53, the P.C. 12 automatically selects all of the narcotics that were previously assigned to the station. Thereafter, for each drug depicted in the "Narcotics Grid" as determined at block 55, the P.C. 12 determines at block 54 whether or not it is to be assigned to the station. In particular, at block 56, the P.C. 12 is responsive to user selection of a drug in the grid to assign it to the station. Alternatively, if the P.C. 12 determines at block 57 that the user cleared the drug selection from the grid, the narcotic is not assigned to the station. At block 58, the P.C. 12 proceeds to the next narcotic listed in the "Narcotic Grid" to determine whether it is to be assigned to the station or not and continues until all of the necessary drugs have been assigned to the station. Thereafter, the P.C. 12 returns to the pick list entry routine at block 59 of FIG. 3B.

At block 59, the user selects a narcotic in the pick list grid depicted for the station. At block 60 the user acknowledges as correct the amount of the drug to be picked in the grid if it is the same as indicated by the pick list records 48 and loaded into the grid at block 46. Alternatively, if a new amount is to be entered for the drug, the user enters the new amount of the drug to be picked into the displayed grid at block 60. At block 61, the P.C. 12 determines whether more narcotics are to be picked for the particular station and if so, proceeds back to block 59. When the user finishes the pick list for a particular station, the P.C. proceeds to block 62 to determine whether pick lists are to be generated for other stations. If so, the P.C. 12 proceeds back to block 43 so that the process can be repeated. When the user has finished the pick list entry process as indicated by the user selecting a displayed "OK button" at block 63, the P.C. 12 proceeds to block 64. At block 64, the pick list records generated during the operation of the flow charts of FIGS. 3A-3C are written to the database pick list records 48.

In order to use the portable scanning and printing system 20 for tracking drugs at a location, the user starts up the system 20 in a banner/log in mode at block 66 of FIG. 4. This mode as depicted in FIG. 5 starts with the processing unit 32 depicting a start up or introduction display screen on the display 28 at a block 72. Thereafter, the processing unit 32 displays a prompt at a block 74 for the user to enter his identification. The user may enter his identification via the keyboard 24 or if the user has a badge or the like with a barcoded identification, the user can enter his identification using the barcode scanner 22. The processing unit 32 receives the entered user identification at a block 76 and thereafter, prompts the user at a block 78 via the display 28 to enter the user's password. The processing unit 32 at block 82 checks the entered password to determine whether the password is valid or not at a block 84. If the password is determined at block 84 to be invalid, the processing unit 32

controls the display 28 to display an error message at block 86, the processing unit 32 thereafter returning to block 74. If the user has entered a valid password, the processing unit 32 returns to the routine depicted in FIG. 4 at block 68. If the processing unit determines at block 68 that a pick list has been suspended, it will proceed at block 69 to the routine depicted in FIGS. 6A-6C. Otherwise, the processing unit proceeds to block 88.

The processing unit 32 at block 88 causes the main menu of the system to be depicted on the display 28. The main menu depicts the various drug tracking operations that can be performed with the portable scanning and printing system 20 including picking operations, receiving operations, outdate operations and an inventory operation. Thereafter, the processing unit 32 receives at a block 90 the user's choice selected via the keyboard 24 and executes the routine 91, 92, 93 or 94 associated with the selected operation.

Upon entering the picking routine at block 91, the processing unit 32 controls the display 28 to depict various picking operation menu choices including a Pick-List Picking operation and No Pick-List Picking operation for the user's selection. If the user selects the option to pick drugs in accordance with a pick-list, the processing unit executes the routines depicted in FIGS. 6A-6C and FIGS. 7A-7D. If the user selects the option to pick drugs without a pick-list, the processing unit executes the routine depicted in FIGS. 9A-9E.

Upon entering the Pick-List Picking routine depicted in FIGS. 6A-6C, the processing unit 32 at a block 96 retrieves one pick-list record from the host system's Pick-List records 48. After receiving at block 98, the pick-list record which contains the identity of a station representing the destination of the drug being a-picked, the identity of a drug including its strength and the quantity of the drug to be picked for that particular station, the processing unit 32 proceeds to block 114. At block 114, at the start of a picking operation for a particular drug, the processing unit 32 displays information identifying the drug to be picked for a particular nursing station to prompt the user to pick the correct drug. This prompt may include National Drug Code (NDC) information i.e., information identifying the name of the drug and its strength. In response to the display of the NDC prompt at block 114, the user scans a barcode, typically contained on a shelf supporting the drug on a drug container itself, where the barcode represents the drug identified in the displayed prompt. At block 116, the processing unit 32 receives from the barcode scanner 22 the data representing the scanned barcode including the NDC. Thereafter, the processing unit determines whether the suspend key of the keyboard 24 has been actuated at a block 118. If so, the processing unit 32 exits the routine. If the suspend key was not pressed as determined at block 118, the processing unit 32 proceeds from block 118 to block 126. At block 126, the processing unit compares the scanned NDC data received at block 116 with the NDC data contained in the pick-list record retrieved from the host system 10. At block 128, the processing unit 32 determines whether these two NDCs match and if not, the processing unit at block 130 displays a message to the user on the display 28 indicating that the user has scanned the wrong NDC code. This feature warns the user that he was about to pick the wrong drug and thus increases the accuracy of the picking operation and thus the drug tracking as well. After displaying the error message at block 130, the processing unit will thereafter return to block 114 to prompt the user via the display 28 to pick the correct drug and associated strength as indicated on the pick-list.

If the processing unit 32 determines at block 128 that the scanned NDC matches the NDC in the pick-list record

received from the host system, the processing unit proceeds from block 128 to block 132. At block 132, the processing unit 32 controls the display 28 to depict a message to the user to prompt the user to enter the quantity to be picked. This prompt will actually display the quantity from the pick-list so as to advise the user of the quantity that the pick-list records indicate should be picked for a particular nursing station. However, the user has the option to select the displayed quantity for picking or to enter a new quantity. At block 134, the processing unit 32 retrieves from the keyboard 24 the quantity of the drug entered by the user as being picked. It is noted, the value that may be retrieved may represent an actual numeric quantity or if the user selects the quantity displayed at block 132, the received quantity information may actually be represented by an indication that an enter key or the like has been pressed indicating to the processing unit 32 that the displayed quantity has been selected by the user and is the "picked" quantity.

After receiving the quantity being picked by the user at block 134, the processing unit 32 proceeds to block 136 to determine whether the suspend key of the keyboard 24 has been actuated and if so, the processing unit 32 exits the routine. If the suspend key was not pressed, the processing unit proceeds from block 136 to block 138. At block 138, the processing unit updates the pick-list record in the memory 34, by associating the user entered quantity being picked with the pick-list record information received from the host system for the particular drug picked. From block 138, the processing unit proceeds to block 140. At block 140, the processing unit 32 sets a flag in Narcotic table stored in the memory 34 indicating that this drug was picked. At block 140, the processing unit also updates the narcotic record for the drug in the memory 34, the record originally received from the host system's Narcotic records 58. When updating the Narcotics record in the memory 34, the processing unit 32 automatically calculates a balance on hand by subtracting the quantity received at block 134 from the old balance in the record. Thereafter, the processing unit proceeds to block 142 from block 140.

At block 142, the processing unit 32 causes the printer 30 to print selected information associated with the picked drug by the processing unit 32 in the memory 34. The information printed on the label includes the intended destination of the drug which is automatically printed to prevent the drug from being sent to the wrong location. The information printed on the label also includes the barcoded NDC data for the drug so that the drug can be tracked by a portable scanning and printing system 20 at its destination location. The automatic continuation of the tracking data throughout various locations of a hospital via the use of multiple portable scanning and printing systems all in communication with the host allows tight control over drugs and current as well as accurate drug tracking records. It is noted, that the user may enter the number of tracking labels to be printed via the keyboard 24 or alternatively, this information may be stored in association with the pick-list data. For example, one label may be printed to be applied to a box containing the picked quantity of a particular drug, or multiple labels may be printed for application to individual drug containers if the drug is so packaged. After the processing unit 32 controls the printer 30 to print the requisite number of labels, the user applies the labels directly to the packaging for the drugs and then continues the picking operation. The processing unit 32 determines at block 144 whether there are more pick records by querying the host system 10. If the host system indicates that there are more pick records, the portable barcode scanning and printing system will receive the next pick-list

record at a block 146 and return to block 114 to display the NDC prompt associated with the next pick-list record.

After picking the drugs for each station on the pick-list as determined at block 144, the processing unit proceeds from block 148 of FIG. 6C to the routine depicted in FIGS. 7A-7D so as to inventory the drugs picked on the pick list. This inventory operation automatically determines whether the quantity of a drug remaining after having been picked for one or more stations matches a balance on hand quantity automatically calculated by the system 20 as the drugs on the pick-list were being picked. In order to inventory the drugs picked in accordance with a pick-list, the processing unit 32 looks to the Narcotics table stored in the memory 34 to determine which of the drugs were marked picked at block 140. For each of the drugs that were marked as picked at block 140 as indicated at block 152, the processing unit 32 implements the remaining steps depicted in the flow charts of FIGS. 7A-C. First, the processing unit controls the display 28 to depict a message to prompt so as to prompt the user to scan a barcode for the displayed NDC information including drug identity and strength. Thereafter, at block 156, the processing unit receives the scanned NDC data from the barcode scanner and proceeds to block 158 to compare the scanned NDC data with the NDC data contained in the Narcotic record stored in the memory 34 for the drug marked as having been picked and identified in the NDC prompt at block 154. At block 160, the processing unit determines whether there is a match between the scanned NDC information and the expected NDC data. If there is not a match, the processing unit 32 depicts an error message at block 162 on the display 28 and proceeds back to block 154 to prompt the user to scan the correct barcode associated with the drug from the pick list being inventoried. If there is a match as determined at block 160, the processing unit 32 proceeds to block 164 to display a balance prompt message. The balance prompt message prompts the user to count the quantity of the drug associated with the scanned NDC remaining at the location after a quantity has been picked, i.e. removed in accordance with the pick-list. After receiving the user entered balance at block 166, the processing unit 32 proceeds to block 168 to determine whether it is the same as the balance calculated and updated by the portable scanning and printing system 20 when executing block 140 each time the drug was picked for a different station on the pick list. If the balance is determined to be correct at block 170 by the unit 32 comparing the user entered balance and the balance on hand stored in memory 34 to determine if they match, the processing unit proceeds to block 172; however, if the balance is not correct, the processing unit proceeds to block 178 as discussed below.

At block 172 the processing unit 32 creates a dispense record in the memory 34 using the pick-list record maintained in the memory 34 where the dispense record confirms the removal of a particular drug from the location. The dispense record identifies the drug including its strength, the quantity removed i.e. dispensed, and the destination of the drug after it was removed from the location. At block 172, the dispense record is also transmitted via the communication interface 26 to the host system so that the host system can update its pick-list records 48 in its memory. From block 172, the processing unit proceeds to block 174. At block 174, the processing unit writes an inventory record for the particular drug indicating the quantity of the drug remaining at the location in the memory 34 and transmits the information to the host system so that the Drug Log memory 175 maintained at the host 10 may be updated with the inventory records from the portable scanning and printing system and

from the pick-list records maintained at the host. From block 174, the processing unit 32 proceeds to block 176 to update the balance on hand in the narcotics record of the memory 34 and the flag in the Narcotics table for the picked drug to indicate that the balance for this drug has been checked and inventoried. The portable scanning and printing system at block 176 also transmits information to the host system to update the Narcotics records contained in the narcotic record memory 58. Thereafter, the processing unit at 177 returns to block 152 to inventory the next drug with the flag still set as indicating that the drug was picked via the pick list but that the balance was not inventoried as of yet.

If the balance received from the user at block 166 is determined by the processing unit 32 to be incorrect at block 170, the processing unit proceeds to block 178 from block 170 to control the display 28 to display an Incorrect Balance Menu. If the user determines that the remaining quantity of the drug was correctly counted and correctly entered into the system 20, the user selects an option to obtain a pharmacist's confirmation of a discrepancy. Upon receiving the selection of pharmacist's confirmation, the processing unit proceeds to block 182 to execute the routine depicted in FIG. 8.

As shown in FIG. 8, the processing unit 32 obtains the pharmacist's user identification at block 184 from one of the input means as discussed above with respect to the user identification. Thereafter, the processing unit receives at block 186 from the keyboard an authorization code entered by the physician. At block 188, the portable scanning and printing system requests information from the host system 10 so as to confirm at block 192 that the correct and valid data was received at block 184 and 186. If the data was not correct, the system 20 will allow the pharmacist to re-enter the information by returning to block 184. Thereafter, the processing unit returns to the routine depicted in FIG. 7D so as to determine at block 194 whether the discrepancy noted in the balance keyed in by the user and the system's records has been confirmed by an authorized pharmacist. If the discrepancy was not confirmed, the processing unit will cause the display 28 to depict the incorrect balance menu at block 178. If however, the pharmacist confirms the discrepancy, the processing unit 32 will proceed to block 196 to set a discrepancy variable equal to the amount of the discrepancy i.e., the difference between the user entered balance representing the counted quantity of the drug remaining at the location and the balance on hand contained in the records of the data system 10. From block 196, the processing unit returns to block 172 to create the necessary records for the drug at blocks 172, 174 and 176 and to transmit the updated records including the discrepancy record to the host system 10 for updating the host's records for the drug.

Because the portable barcode scanning and printing system automatically prompts the user to pick a particular drug for a particular station by displaying the identity of the drug and the station identity as well at block 114, the user is lead through the picking operation very easily so as to improve accuracy of the picking and the drug tracking. Further, because the portable scanning and printing system is collecting the information entered by the user, such as the scanned drug identity data and keyboard entered quantity data, and is associating the data received from the different input means in the memory 34 with a particular pick-list record and drug or narcotics record received from the host, the system 20 can select portions of the associated data for printing labels and/or reports via the barcode printer 30. The system 20 can also automatically create and/or update different drug tracking records. By thereafter transmitting

the updated records to the host system for storage, the record keeping operation is automatically accomplished and greatly simplified so as to improve the accuracy of the drug tracking operation.

FIGS. 9A-9E illustrates a software routine executed by the portable scanning and printing system 20 to allow drugs to be picked and inventoried without receipt of a picking list from the host system and to allow drugs to be received, i.e. added to the location so as to provide a drug tracking receiving operation. The routine depicted in FIGS. 9A-E can be entered from the picking routine 91 if the No Pick-List Picking operation is selected or it may be entered from the Receiving routine 92 as shown in FIG. 4. Upon entering the routine of FIGS. 9A-E, the processing unit 32 at block 200 displays a prompt for the station i.e. the intended destination for the drug if in the No Pick List Picking mode or the source of the drug if in the Receiving mode. It is noted, that in the Receiving mode, the source of the drug can either be a wholesaler identification or, for example, a nursing station that is returning a drug. Upon receiving a station identification at block 202 from either the scanner 22 or keyboard 24, the processing unit 32 at block 204 validates the station by communicating with the host system 10 utilizing the station records 42 of the host's memory. Thereafter, if the processing unit determines at block 206 that the station information received at block 202 is valid, the processing unit proceeds to block 208. Otherwise, the processing unit returns to block 200 to prompt the user to re-enter the station identification. At block 208, the processing unit controls the display 28 to prompt the user to enter NDC data for the drug being picked or received from the barcode scanner 22, the processing unit proceeds to block 214 to validate the scanned NDC code received at block 210 by communicating with the host system 10 using the narcotics records 58 of the host system's memory. The validation by the portable scanning and printing system 20 can be accomplished by the processing unit 32 comparing NDC information received from the host's narcotics records 58 to the user entered NDC information to determine if there is a match. Alternatively, the validation by the portable scanning and printing system 20 can be accomplished by the processing unit 32 transmitting the user entered NDC data to the host system and the P.C. 12 comparing the user entered NDC data with the NDC data contained in the host's narcotics records 58. The host then transmits the result of the comparison to the portable scanning and printing system 20. Based on the information received from the host system, the processing unit 32 determines at block 216 whether the scanned or keyboard entered NDC code is valid. If it is not valid, the processing unit 32 controls the display 28 to display an error message at block 218 and returns to block 208 to again prompt for the entry of the NDC information. If the user entered NDC code is determined to be valid at block 216, the processing unit 32 proceeds to block 220.

The processing unit 32 at block 220 controls the display 28 to display a message to prompt the user to enter the quantity to be picked or the quantity to be received depending on the mode. At block 222, the processing unit 32 receives the quantity data from the keyboard 24 and thereafter displays at block 224 a prompt for the user to enter the balance remaining after the quantity of the drug entered at block 222 has been removed from the location for picking or added to the location for receiving. At block 226, the processing unit 32 receives the balance data keyed in by the user and at block 228, the processing unit 32 validates the user entered balance by communicating with the host system

10 using the balance on hand information contained in the Narcotics record 58 of the host system's memory. As discussed above, this validation at block 228 may be implemented by the portable scanning and printing system 20 by the processing unit 32 comparing the user entered balance with the balance on hand information transmitted from the host system 10 or by the host system comparing the user entered balance as transmitted by the system 20 with the balance on hand data stored in the narcotics records 58 in which case the host transmits a message back to the portable scanning and printing system 20 with the results of the match. From block 228, the processing unit proceeds to block 230 to determine whether the user entered balance is correct for validation. If the user entered balance is validated at block 230, the processing unit proceeds to block 234 to write a Pick record from data stored in the memory 34 in association with the station entered at block 202, the NDC entered at block 210, the quantity entered at block 22 and the balance entered at 226. This Pick record is stored in the memory 34 and block 234 and transmitted to the host system so as to update the Drug Log 175 in the host's memory. The processing unit 32 also stores an inventory record in the memory 34 at block 236 and transmits the inventory record to the host processing system for updating the Drug Log 175 in the host's memory. At block 238, the balance on hand for the drug is updated in the memory 34 and transmitted to the host system 10 for updating the host's Narcotics records 58. From block 238, the processing unit proceeds to block 254 shown in FIG. 11E so as to display a menu to allow the user to pick or receive more drugs by returning to block 200 or to allow the user to exit the routine.

If the processing unit 32 does not validate the user entered balance at block 230, the processing unit proceeds to block 240. At block 240, the processing unit displays an Incorrect Balance Menu on the display 28 and proceeds to block 242 to obtain the user's menu selection. One option depicted on the Incorrect Balance Menu at block 240 is to obtain pharmacist confirmation of a discrepancy which will be selected if the user determines that he has correctly counted and correctly entered the values prompted for at block 220 and 224. If this menu choice is selected by the user, the processing unit 32 proceeds from block 242 to block 246. At block 246, the processing unit executes the routine depicted in FIG. 8 and thereafter proceeds to block 248 to determine whether the discrepancy has been confirmed by an authorized physician as discussed above. If the discrepancy was not confirmed, the processing unit proceeds from block 248 to block 234 and if the discrepancy was confirmed, the processing unit proceeds to block 250. At block 250, the processing unit writes a Discrepancy record in the memory 34 and transmits the Discrepancy record to the host system 10 so as to update the host's Discrepancy Log 251.

If the user selects an outdates operation from the menu 88 depicted in FIG. 4, the outdates routine 93 allows the user to select either an outdate safe inventory routine or an outdate received narcotics routine. The outdate safe inventory routine allows drugs that are stored in the safe and inventoried therein to be outdated by removing the drugs from their current location within the safe to an outdated area for destruction. The outdate received narcotics routine allows drugs received from a nurse's station to be outdated without performing an inventory.

The outdate safe inventory routine is depicted in FIGS. 10A-10D. In this routine, the processing unit 32 first obtains pharmacist confirmation at block 260 by executing the routine depicted in FIG. 8 since a pharmacist is required to handle the outdate procedure. If a pharmacist is not con-

firmed by the processing unit as determined at block 262, the processing unit exits the routine. However, if confirmation is obtained at block 262, the processing unit 32 proceeds to block 264 to display a message prompting the user to enter NDC data for the drug to be outdated. Upon receiving the NDC data from either the barcode scanner 22 or the keyboard 24 at block 266, the processing unit 32 proceeds to block 268 to validate the user entered NDC data by communicating with the host system using the narcotics records 58 of the host as discussed above. If the processing unit 32 determines at block 270 that the user entered NDC information is not valid, the processing unit controls the display to depict a message to that effect at block 272 and returns back to block 264 to again prompt the user to enter the NDC information. If the processing unit 32 determines that a valid NDC code has been entered by the user, the processing unit proceeds from block 270 to block 274 to display a message to the user to prompt the user to enter the quantity of the drug to be outdated from the safe's inventory. The processing unit at block 276 receives the user entered quantity from the keyboard 24. At block 278 the processing unit controls the display 28 to depict a message prompting the user to enter the quantity of the drug remaining after the quantity of the drug entered at block 276 has been removed from the location for outdated.

The processing unit 32 receives this user entered balance information from the keyboard 24 at block 280. Thereafter, the processing unit 32 at block 282 validates the user entered balance by communicating with the host system using the narcotics records 58 of the host as discussed above. At block 284, the processing unit 32 determines whether the balance is valid, i.e., whether it matches the balance on hand maintained in the host's narcotics records and if so, the processing unit proceeds to block 292. If the user entered balance is determined to be invalid at block 284, the processing unit proceeds to block 286 to display an Incorrect Balance Menu on the display 28 and thereafter receives the user's selection at block 288. The Incorrect Balance Menu allows the user to acknowledge the discrepancy. If the discrepancy is acknowledged, the processing unit proceeds to block 290 to calculate a discrepancy amount, i.e. the difference between the user entered balance and the balance on hand from the host's narcotics records 58 and to assign this calculated value to a discrepancy field. At block 292, the processing unit updates the outdate record in the memory 34 and transmits the outdate record to the host to update the host's Drug Log 175. At block 294, the processing unit updates the inventory record in the memory 34 and transmits the inventory record to the host system to update the drug logs 175 with the information contained therein. The host processing system also updates the balance on hand in the memory 34 at block 296 and transmits this information to the host system for updating the host's narcotics records 58. Thereafter, an outdate record is updated in the memory 34 at block 298 and transmitted to the host 10 so as to update the expired drug log 300 maintained in the host's memory.

The Outdate Received Narcotics routine is depicted in FIGS. 11A-11B. Upon entering this routine, the processing unit at block 302 executes the pharmacist's confirmation routine depicted in FIG. 8. Upon obtaining information that an authorized pharmacist is performing the outdate procedure as determined by the processing unit at block 304, the processing unit 32 proceeds to block 306 to display a message on the display 28 to prompt the user to enter the station, i.e. the source, of the drug to be outdated. At block 308, the processing unit receives the station information entered by the user via the input means and proceeds to

block 310. At block 310 the processing unit 32 validates the user entered station by communicating with the host system 10 using the host's station records 42. At block 312, the processing unit determines whether the user entered station is valid and if not, controls the display 28 to depict an error message 314. From block 314, the processing unit returns to block 306. If the user entered station is determined to be valid at block 312, the processing unit proceeds to block 315 to control the display 28 to depict a message prompting the user to enter NDC data for the drug to be outdated from the identified station. At block 316, the processing unit receives the user entered NDC data and at block 318 validates the user entered data by communicating with the host system using the host's narcotics records 58. At block 320, the processing unit determines whether the user entered NDC information is valid and if not the processing unit controls the display 28 at block 324 to display an error message and the processing unit returns to block 315. If the processing unit determines at block 320 that the user entered NDC information is valid, the processing unit at block 326 controls the display 328 to depict a message to prompt the user to enter the quantity of the drug to be outdated. Thereafter, at block 328, the processing unit receives the user entered quantity. At block 330 the processing unit updates an outdated record in the memory 34 and transmits the outdated record to the host system 10 to update the Expired Drug Log record 300 in the host's memory.

If a user selects the inventory operation from the main menu displayed at block 88, at block 94 of FIG. 4, the processing unit 32 executes the routine depicted in FIGS. 12A-12C. This routine allows an inventory operation to be performed independent of picking, receiving and outdated. Upon entering the inventory routine at block 332, the processing unit 32 controls the display 28 to depict a message to prompt the user to enter NDC information. At block 334 the processing unit receives the entered NDC information from the input means used. The processing unit 32 then validates at block 336 the user entered NDC data by communicating with the host system 10 using the host's narcotics records 58. If the processing unit 32 determines at block 338 that the user entered NDC information is not valid in that it does not match a NDC code contained within the host's narcotics records 58, the processing unit proceeds to block 340 to control the display 28 to depict an error message. Thereafter, the processing unit proceeds to block 332 from block 340. If the user entered NDC data is determined to be valid at block 338 the processing unit at block 342 prompts the user to enter a balance value representing a quantity of the drug currently maintained at the location. At block 342, the processing unit receives the user entered balance data and proceeds to block 344. At block 344, the processing unit 32 validates the user entered balance by communicating with the host system 10 using the host's systems narcotics records 58. At block 346, the processing unit determines whether the user entered balance is valid and if so, the processing unit proceeds to block 348. At block 348, the processing unit updates an inventory record in the memory 34 and transmits the inventory record to the host system 10 so as to update the Drug Log 175 of the host's memory. At block 350, the processing unit updates the balance on hand data in the memory 34 and transmits the balance on hand information to the host system 10 so as to update the host's narcotics records 58. Thereafter, the processing unit proceeds to block 352 to display a menu to the user which allows the user to select an option to exit the routine or to select an option to inventory another drug maintained at the location. If the latter option is selected by

the user, the processing unit proceeds from block 354 to block 332 to prompt the user to enter the NDC information associated with the next drug to be inventoried.

If the processing unit 32 determines at block 346 that the user entered balance is not valid, the processing unit proceeds from block 346 to block 356. At block 356, the processing unit controls the display 28 to depict an Incorrect Balance Menu. This menu allows the user to obtain pharmacist confirmation of a discrepancy. The processing unit proceeds from block 358 to block 360. At block 360, the processing unit obtains pharmacist confirmation by executing the routine depicted in FIG. 8. At block 362, the processing unit determines whether a pharmacist has confirmed the discrepancy and if not, the processing unit returns to block 356. If the discrepancy is confirmed as determined at block 362, the processing unit proceeds to block 364. At block 364 the processing unit updates a discrepancy record in the memory 34 and transmits the discrepancy record to the host system 10 via the communication interface 26 to update the Discrepancy Log maintained at the host system. Thereafter, at block 364, the processing unit marks an inventory record discrepancy flag associated with the inventoried drug in the memory 34 and proceeds from block 366 to block 348.

Many modifications and variations of the present invention are possible in light of the above teachings. For example, the drug tracking method of the present invention can be used at locations other than a drug safe including the nursing stations and any other source and/or destination of a drug. Further as noted above, the processing unit 32 may include one or more microprocessors. If multiple microprocessors or the like are employed, the above-described operations could be performed by any one or combination of the processors. For example, one processor could control scanning operations, another processor could control data collection operations and another processor might control printing operations as will be readily apparent to one of ordinary skill in the art. Because validation of user entered data, whether via the scanner 22 or keyboard 24, is performed automatically and non-validation results in a displayed prompt to the user to correct or confirm a discrepancy before proceeding, the user is forced to deal with the discrepancy immediately, when counting errors and data entry errors are most easily corrected. Thus, the system and method of the present invention increases the accuracy of the drug tracking operation. Thus, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as described hereinabove.

What is claimed and desired to be secured by Letters Patent is:

1. A method of operating a portable scanning and printing system for tracking drugs maintained at a location, the portable scanning and printing system having a memory for collecting data, a display, a barcode printer and a plurality of input means including a barcode scanner, a keyboard and a wireless communication interface to allow wireless communication with a host system having a memory for storing drug tracking records, comprising:

receiving user identification information from one of the input means;
 receiving from the scanner scanned barcode data representing the identity of a drug maintained at the location;
 receiving from the keyboard data confirming a quantity of the drug being removed or added;
 associating in the portable scanning and printing system memory, data received from a plurality of the input means for a drug;

the drug and storing the received balance in association with the drug identity.

17. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 16 including the step of automatically updating the stored balance by subtracting a confirmed quantity of a drug being removed from the stored balance to provide a new balance that is stored or by adding a confirmed quantity of a drug being added to the stored balance to provide a new balance that is stored.

18. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 including the step of transmitting a validated user entered balance to the host system.

19. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 wherein the step of validating includes transmitting a user entered balance to the host system for comparison to a balance stored in the host system for the drug to determine whether there is a match and receiving from the host system a result of the host system's comparison.

20. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 wherein the step of prompting the user to deal with the discrepancy includes displaying a message to the user to obtain a pharmacist's confirmation.

21. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 wherein the step of prompting the user to deal with the discrepancy includes displaying a message to the user to prompt re-enter of information.

22. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 wherein the step of prompting the user to deal with the discrepancy includes displaying a message to the user with a selectable option to obtain confirmation of the discrepancy by an authorized person.

23. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 including the step of printing information on a label including a barcode identifying the drug being removed or added.

24. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 23 including the step of receiving information identifying a source of a drug being added or a destination of a drug being removed and wherein the step of printing includes printing information including the source or destination of a drug.

25. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 13 including the steps of

receiving from the host system via the communication interface information identifying a drug to be removed from the location, a quantity of the drug to be removed and an intended destination;

displaying information to the user to prompt the user to select a drug identified by information received from the host system;

receiving from the scanner scanned barcode data representing the identity of a drug maintained at the location; comparing the identity of the drug represented by the scanned barcode data to the identity of the drug received from the host system; and

displaying an error message to the user if the identity of the drug represented by the scanned barcode does not match the identity of the drug received from the host system.

26. A method of operating a portable scanning and printing system for tracking drugs maintained at a location, the portable scanning and printing system having a memory for collecting data, a display, a barcode printer and a plurality of input means including a barcode scanner, a keypad and a wireless communication interface to allow wireless communication with a host system having a memory for storing drug tracking records comprising:

receiving from the host system via the communication interface information identifying a drug to be removed from the location, a quantity of the drug to be removed and an intended destination;

displaying information to the user to prompt the user to select a drug identified by information received from the host system;

receiving from the scanner scanned barcode data representing the identity of a drug maintained at the location; comparing the identity of the drug represented by the scanned barcode data to the identity of the drug received from the host system; and

displaying an error message to the user if the identity of the drug represented by the scanned barcode does not match the identity of the drug received from the host system.

27. A method of operating a portable scanning and printing system for tracking drugs maintained at a location as recited in claim 26 including the step of printing information on at least one label for the drug being removed, the printed information including the identity of the drug and the intended destination.

28. A method of operating a portable scanning and printing system for tracking drugs maintained at a location as recited in claim 26 including the steps of

receiving user identification information from one of the input means;

receiving information from the keyboard confirming a quantity of the drug being removed; and

transmitting to the host station via the communication interface information regarding the removal of the drug from the location including the user's identification, the identity of the drug and the quantity of the drug being removed.

29. A method of operating a portable scanning and printing system for tracking drugs maintained at a location as recited in claim 28 including the steps of

receiving from the keyboard user entered balance data representing a quantity of the drug remaining at the location;

receiving from the host system via the communication interface data representing a balance of the drug stored in the host system's drug tracking records; and validating the user entered balance data with information received from the host.

30. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 29 wherein the validating step includes comparing the balance data received from the host with the user entered balance data.

31. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 29 wherein the validating step includes updating the balance data received from the host to account for a received confirmed quantity of the drug being removed; and comparing the balance data received from the host with the user entered balance data.

32. A method of operating a portable scanning and printing system for tracking drugs maintained at a location, the

portable scanning and printing system having a memory for collecting data, a display, a barcode printer and a plurality of input means including a barcode scanner, a keypad and a wireless communication interface to allow wireless communication with a host system having a memory for storing drug tracking records comprising:

- receiving from the scanner scanned barcode data representing the identity of a drug maintained at the location;
- receiving from the keyboard data confirming a quantity of the drug being added to the location or removed from the location;
- transmitting to the host system via the communication interface information regarding a drug's addition to or removal from the location including the identity of the drug and the quantity of the drug being added to or removed from the location;
- receiving from the keyboard user entered balance data confirming a quantity of the drug maintained at the location after the drugs addition to or removal from the location; and
- validating the user entered balance data by communicating with the host system; and
- prompting the user to obtain confirmation of a discrepancy if the user entered balance is not valid.

33. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 wherein said step of validating includes comparing a stored balance for the identified drug to the user entered balance to determine whether there is a match.

34. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 33 including the step of receiving data from the host system via the wireless communication interface representing a balance for the drug and storing the received balance in association with the drug identity.

35. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 34 including the step of automatically updating the stored balance by subtracting a confirmed quantity of a drug being removed from the stored balance to provide a new balance that is stored or by adding a confirmed quantity of a drug being added to the stored balance to provide a new balance that is stored.

36. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 including the step of transmitting a validated user entered balance to the host system.

37. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 wherein the step of validating includes transmitting a user entered balance to the host system for comparison to a balance stored in the host system for the drug to determine whether there is a match and receiving from the host system a result of the host system's comparison.

38. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 wherein the step of prompting the user to includes displaying a message to the user with a selectable option to re-enter the user entered balance.

39. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 wherein the step of prompting the user to includes displaying a message to the user with a selectable option to re-enter the quantity of the drug being removed or added.

40. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 including the step of generating a record of a discrepancy upon confirmation of the discrepancy by an authorized person; and transmitting a discrepancy record to the host upon confirmation.

41. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 including the step of printing information on a label including a barcode identifying the drug being removed or added.

42. A method of operating a portable scanning and printing system for tracking drugs as recited in claim 32 including the step of receiving information identifying a source of a drug being added or a destination of a drug being removed and wherein the step of printing includes printing information including the source or destination of a drug.

43. A method of operating a portable scanning and printing system for tracking drugs maintained at a location, the portable scanning and printing system having a memory for collecting data, a display, a printer and a plurality of input means including a barcode scanner, a keyboard and a wireless communication interface to allow wireless communication with a host system having a memory for storing drug tracking records comprising:

- receiving from the scanner scanned barcode data representing the identity of a drug maintained at the location;
- transmitting to the host system data representing the identity of the drug received from the scanner;
- receiving information from the host system representing the validity of the identity of the drug transmitted to the host;
- receiving from the keyboard data representing a quantity of the drug maintained at the location;
- receiving from the host system data representing the balance of the drug that the host's data tracking records indicate should be remaining at the location;
- comparing the quantity of the drug maintained at the location as received from the keyboard and the balance received from the host to determine if they match; and
- displaying a selectable option to the user to allow a confirmation of a discrepancy by an authorized person if the comparison results in a no match determination.



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(54) **METHOD AND APPARATUS FOR
TRANSMITTING A DIGITAL INFORMATION
SIGNAL AND VENDING SYSTEM
INCORPORATING SAME**

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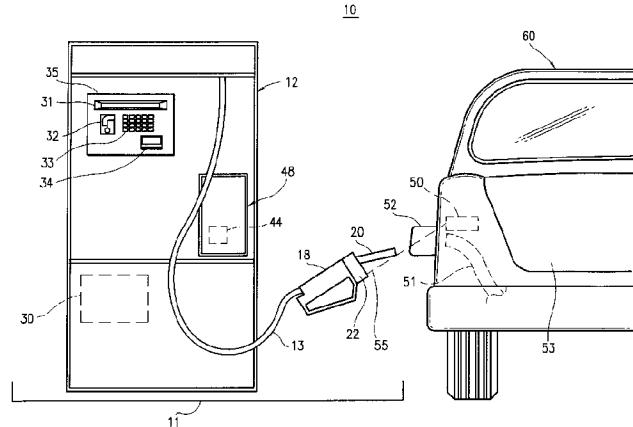
(57) **ABSTRACT**

A cashless business transaction system (e.g., a vending system, a material tracking system, or a highway toll system) incorporates a method and apparatus for transmitting a digital information signal. A signal generator (311) generates a constant frequency signal. A phase modulator (305) varies the instantaneous phase of the constant frequency signal to represent digital information, thereby producing a phase modulated signal (325). A tuned resonant circuit (307) filters and averages the phase modulated signal to produce a simulated FM signal, and transmits the simulated FM signal via its antenna (309). One such business transaction system (e.g., a vending system) incorporates such a transmitter to facilitate transmission of billing information from a device located within a substantially electrically shielded environment. Another such business transaction system preferably incorporates such a transmitter to facilitate half-duplex transmission of digital information regardless of whether or not the digital information is transmitted from a device located within a substantially electrically shielded environment.

37 Claims, 14 Drawing Sheets

Microfiche Appendix Included

(1 Microfiche, 82 Pages)



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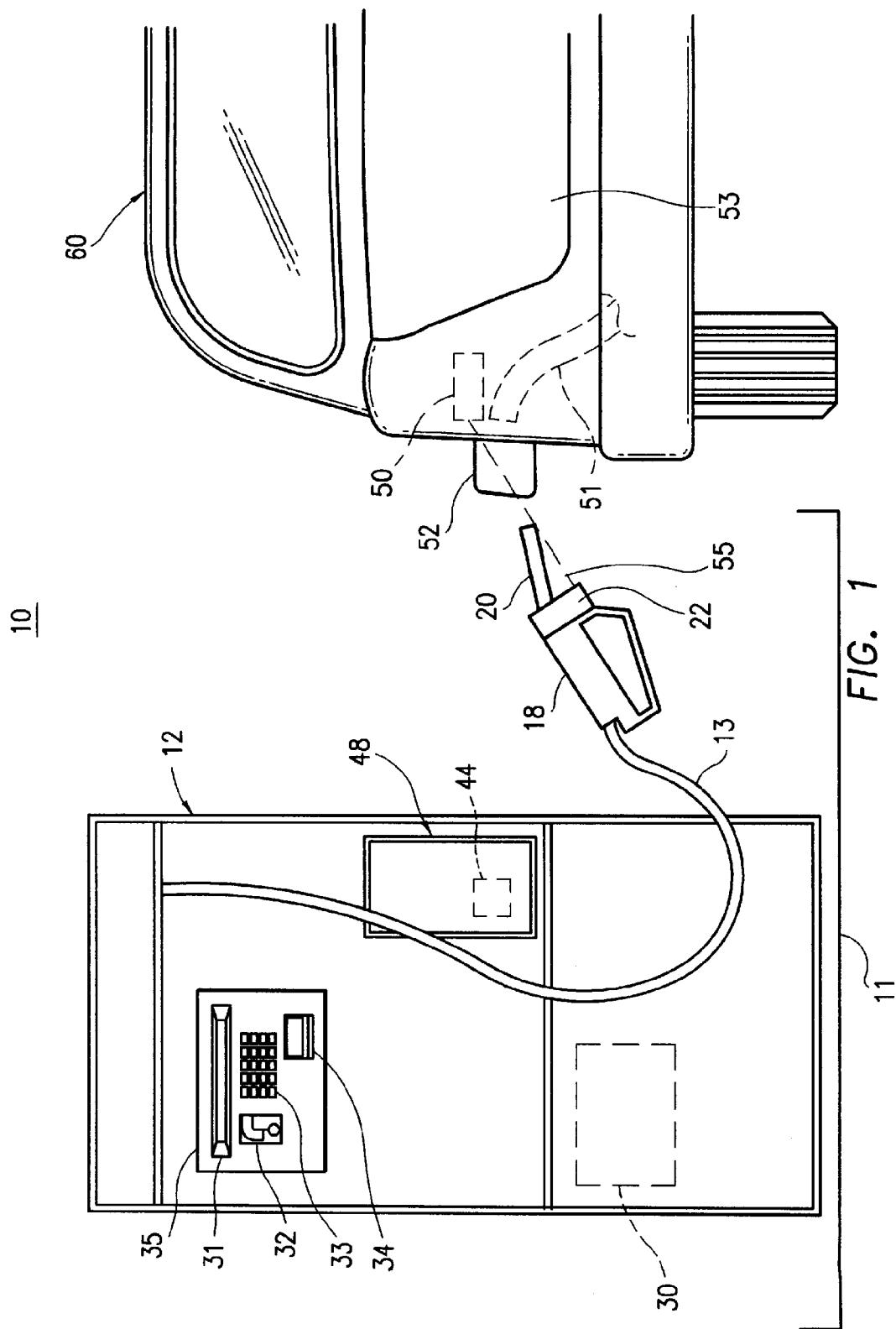
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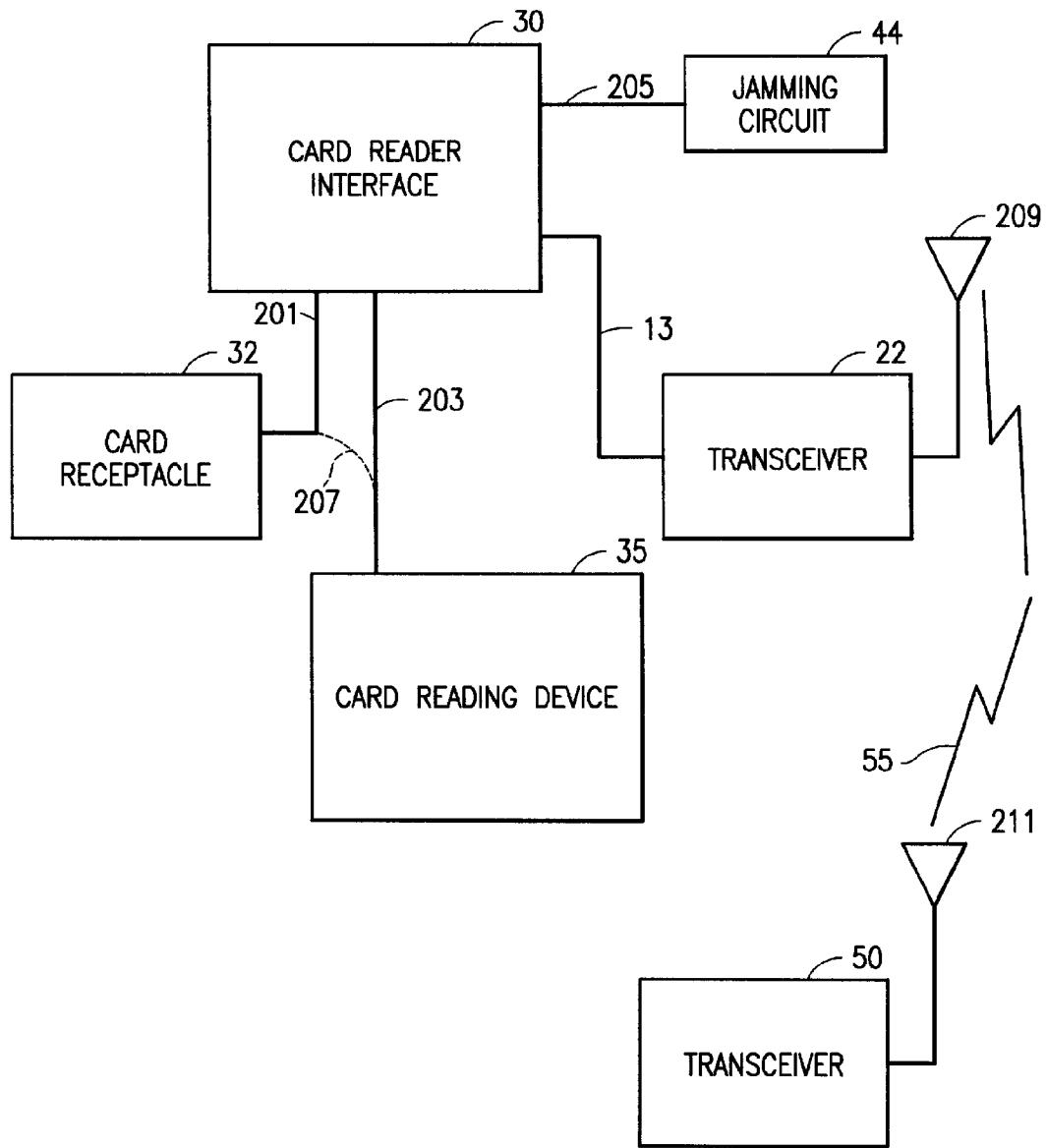
10

FIG. 2

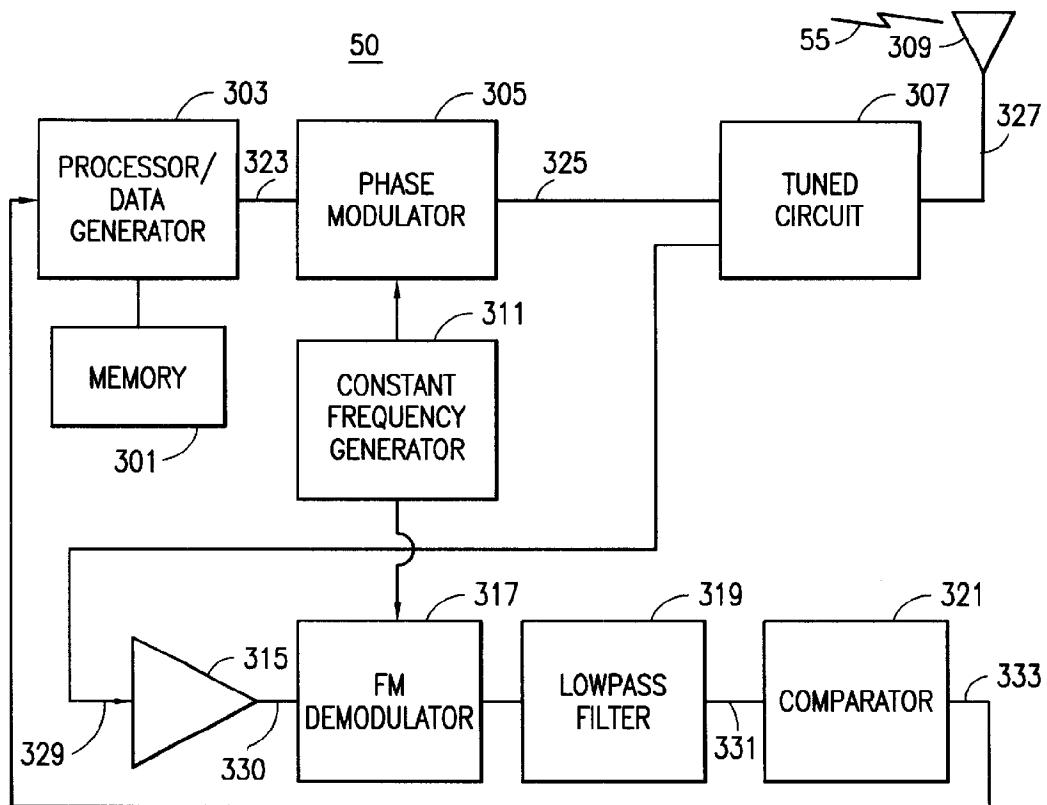


FIG. 3

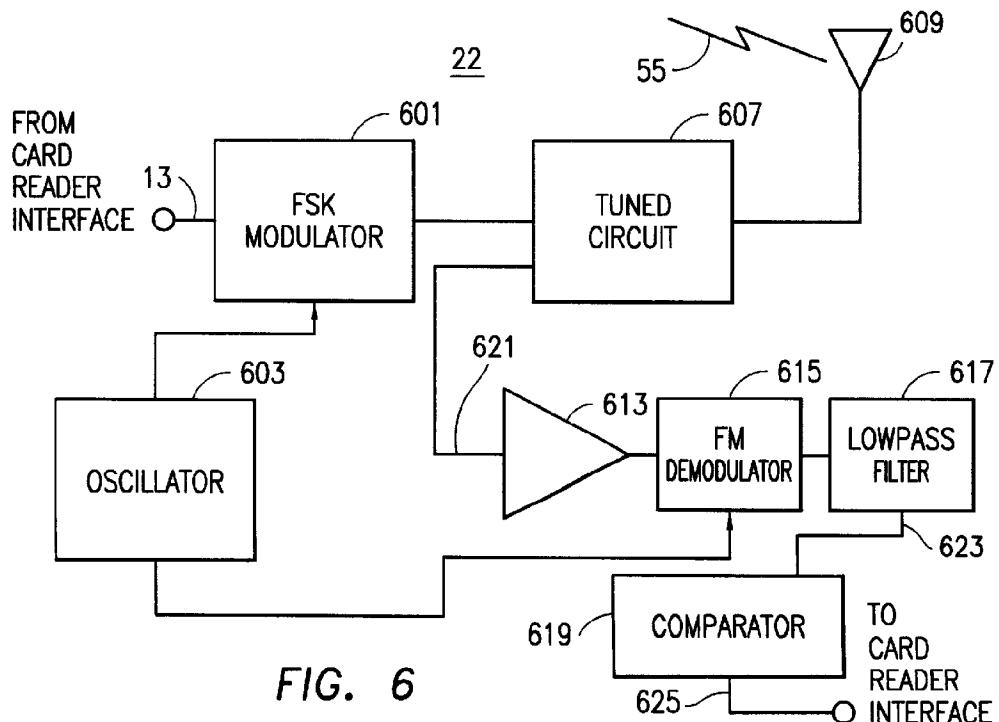


FIG. 6

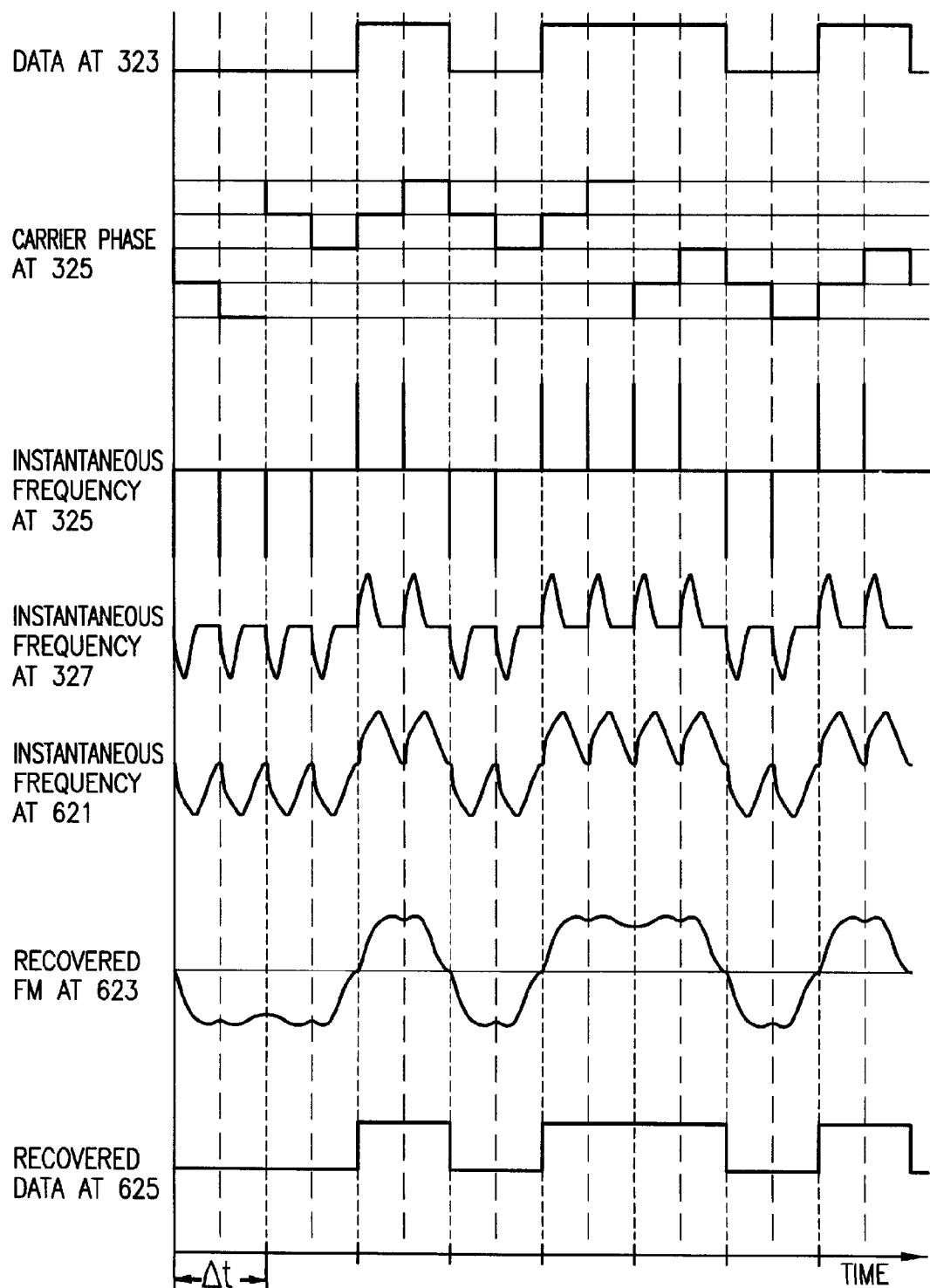
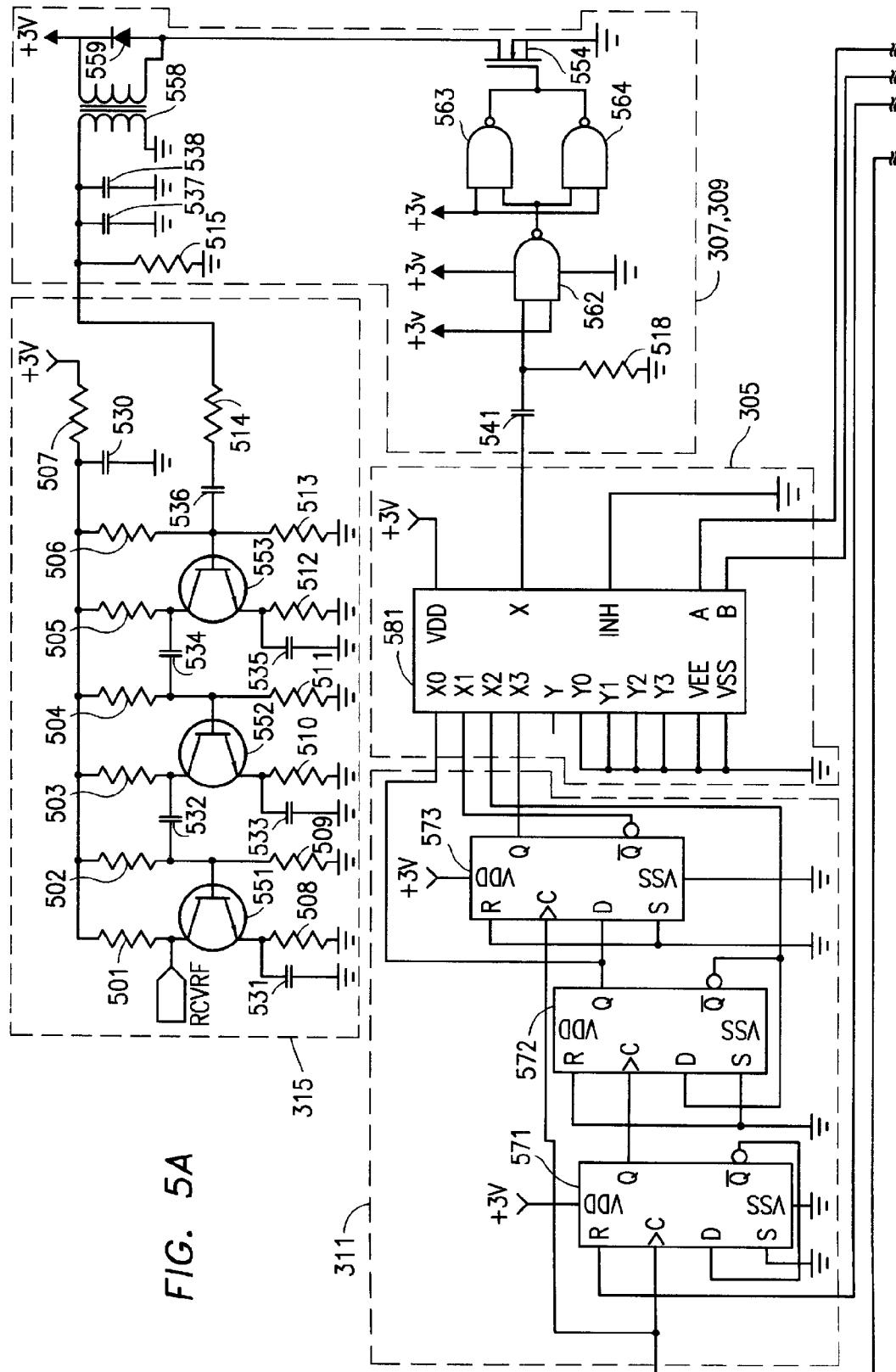


FIG. 4



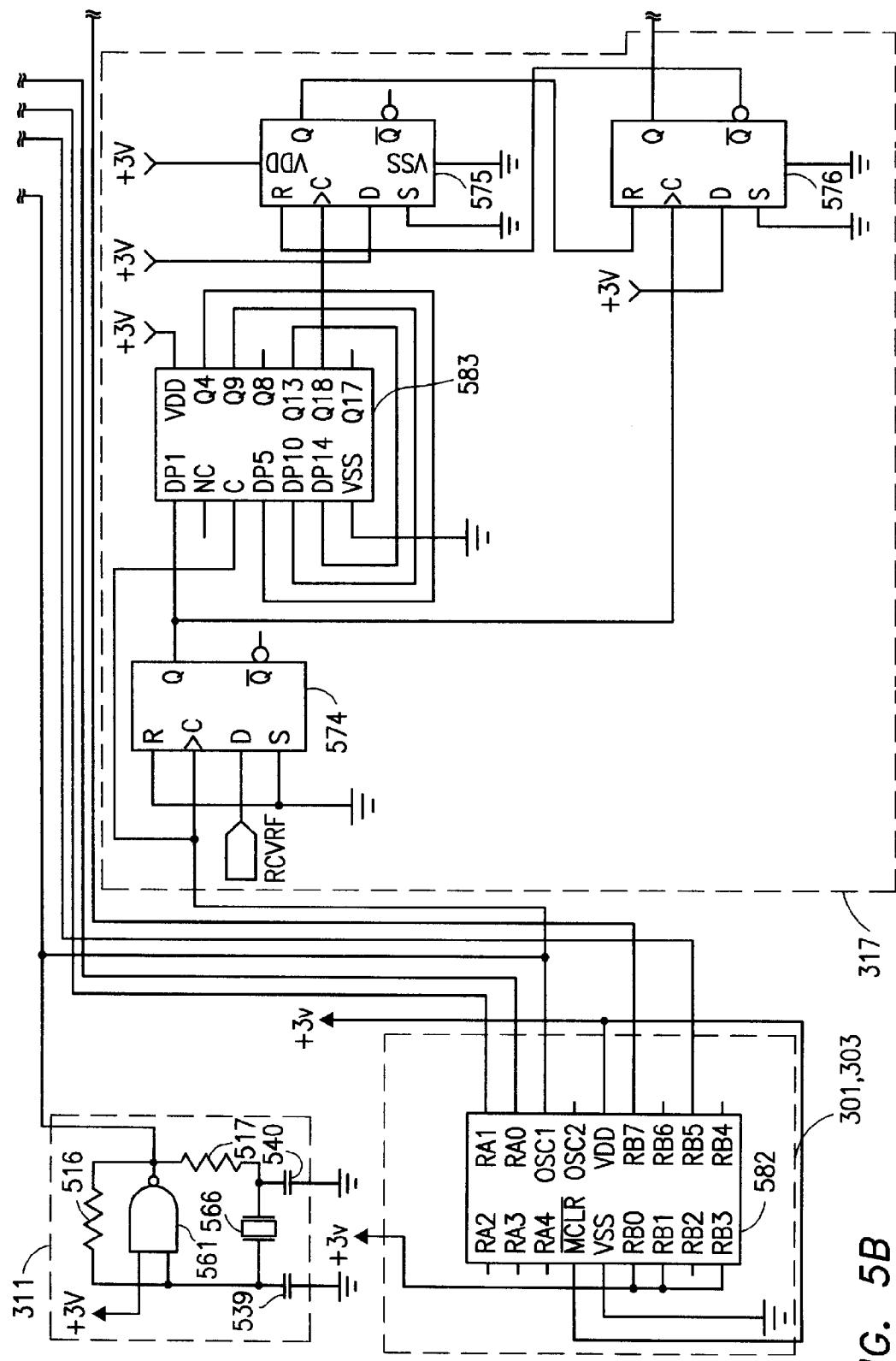


FIG. 5B

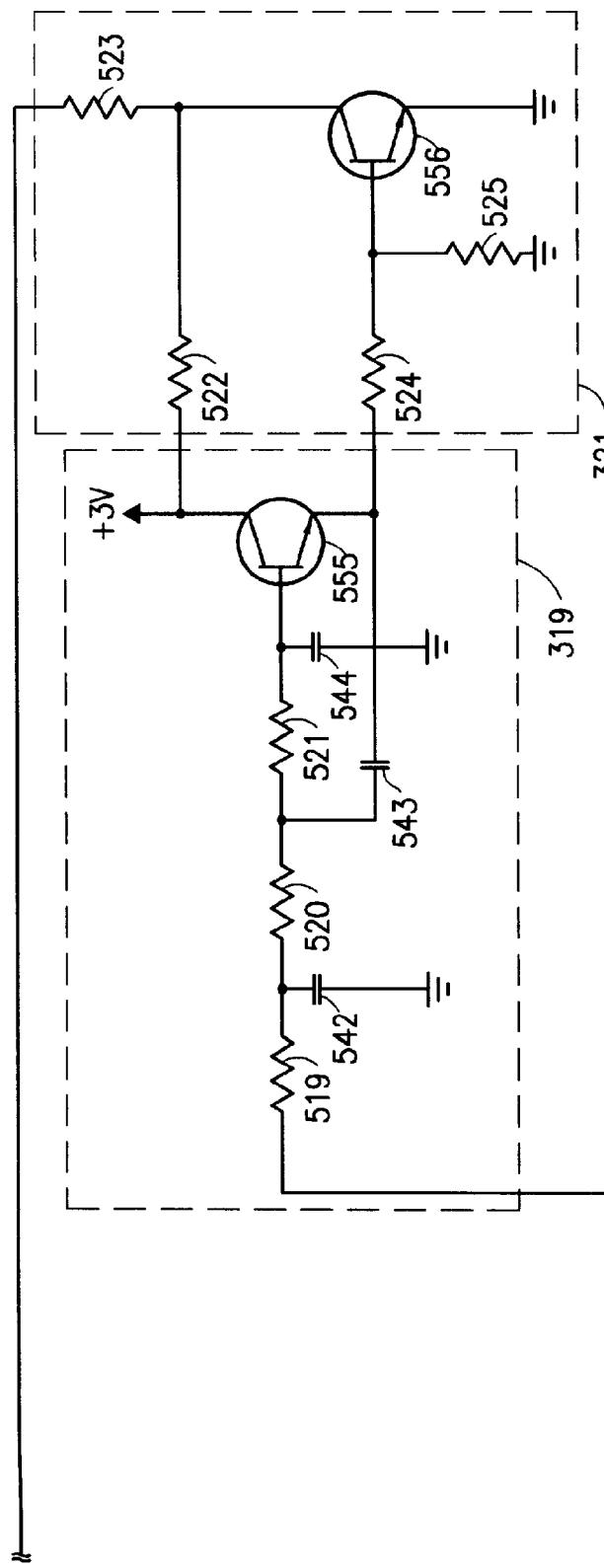
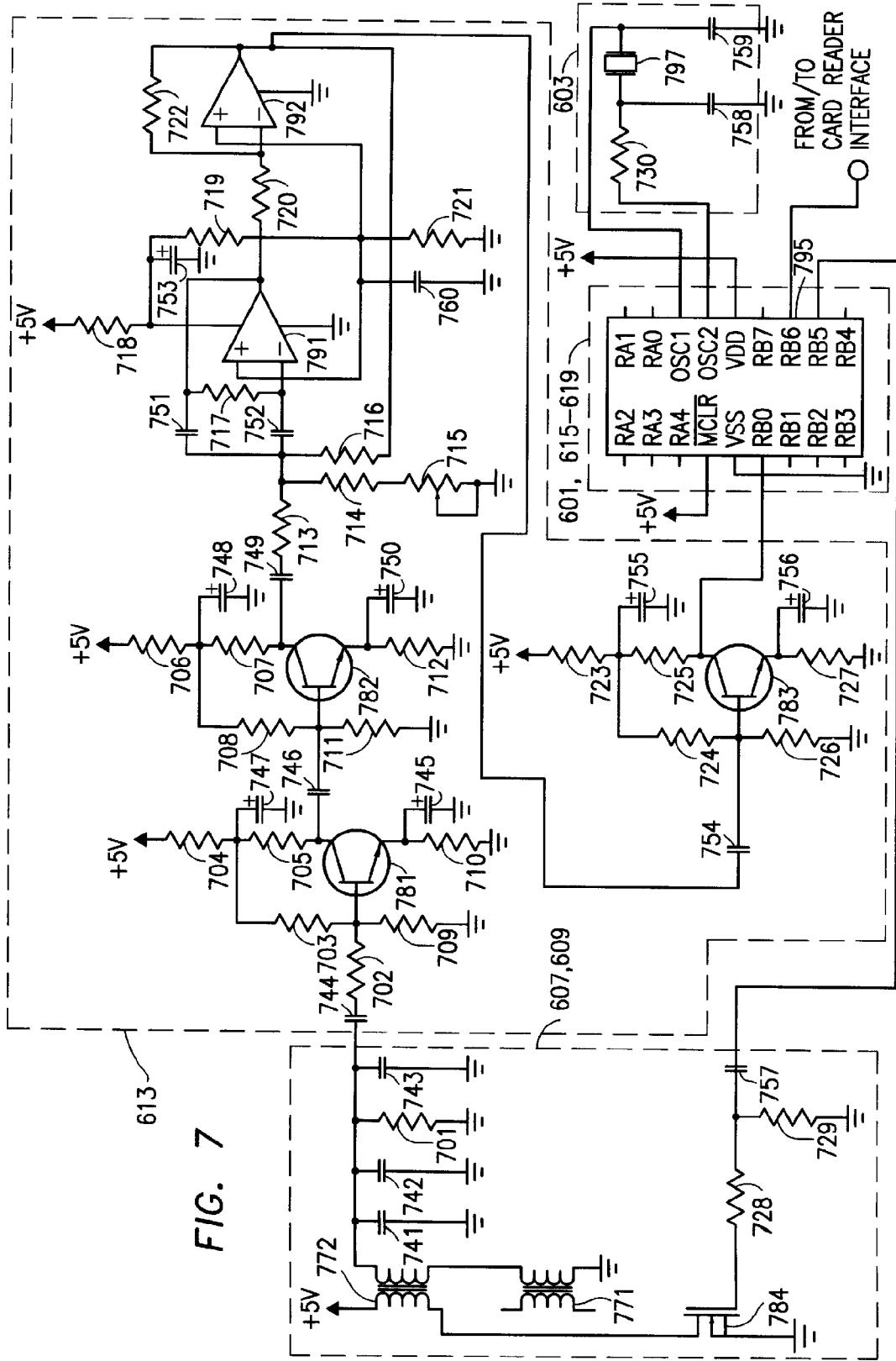


FIG. 5C

FIG. 7



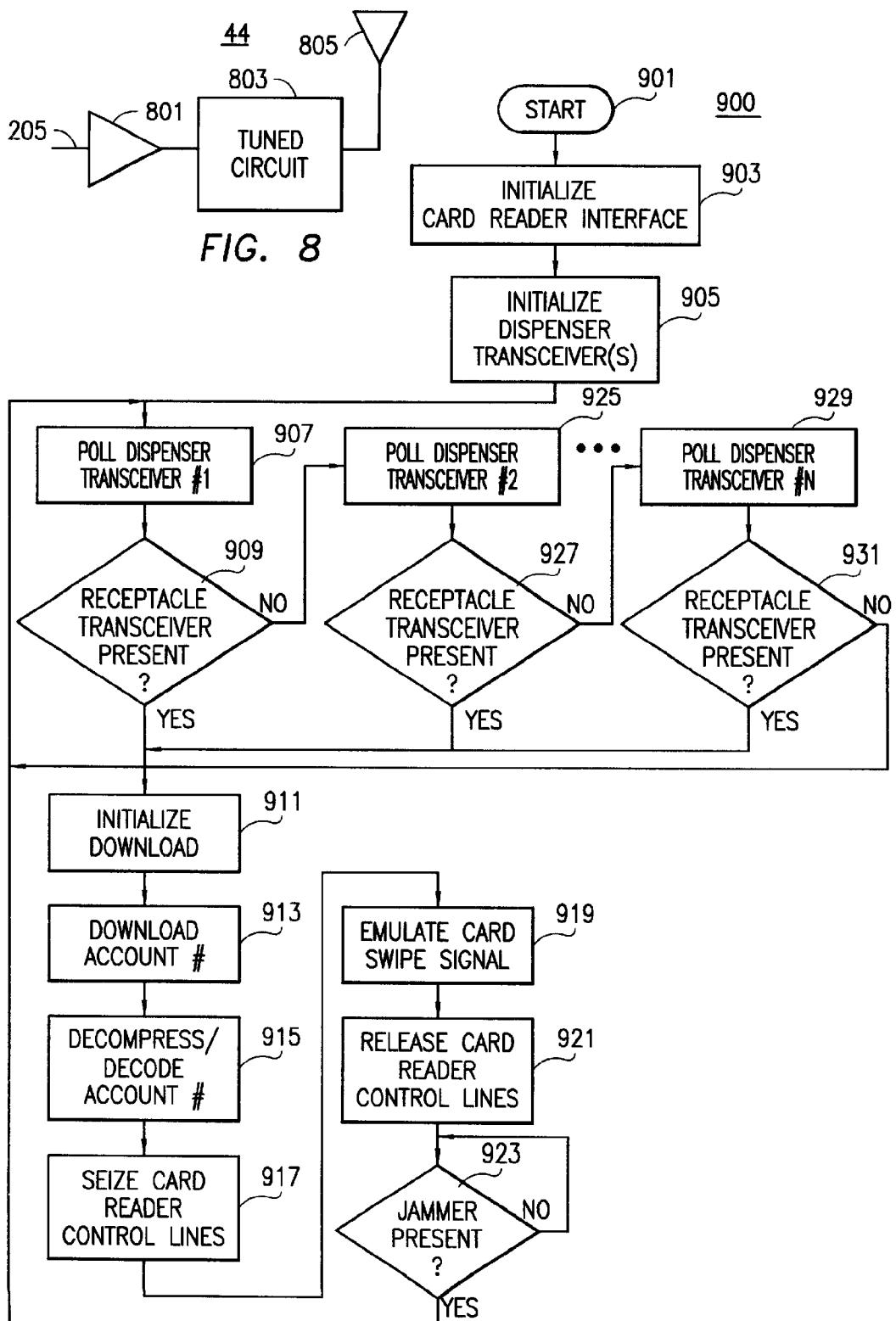
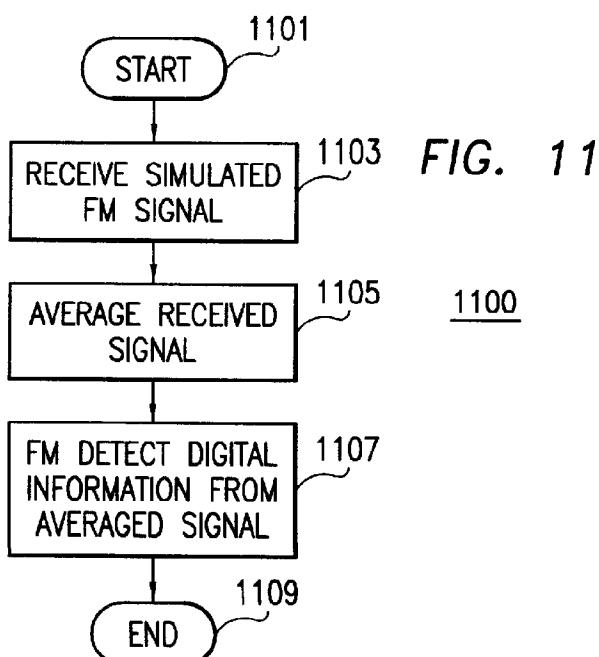
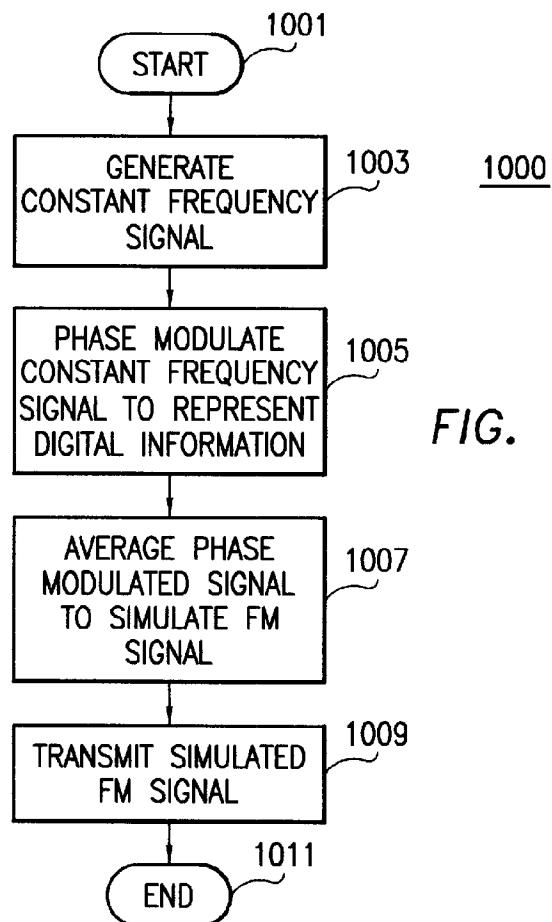


FIG. 9



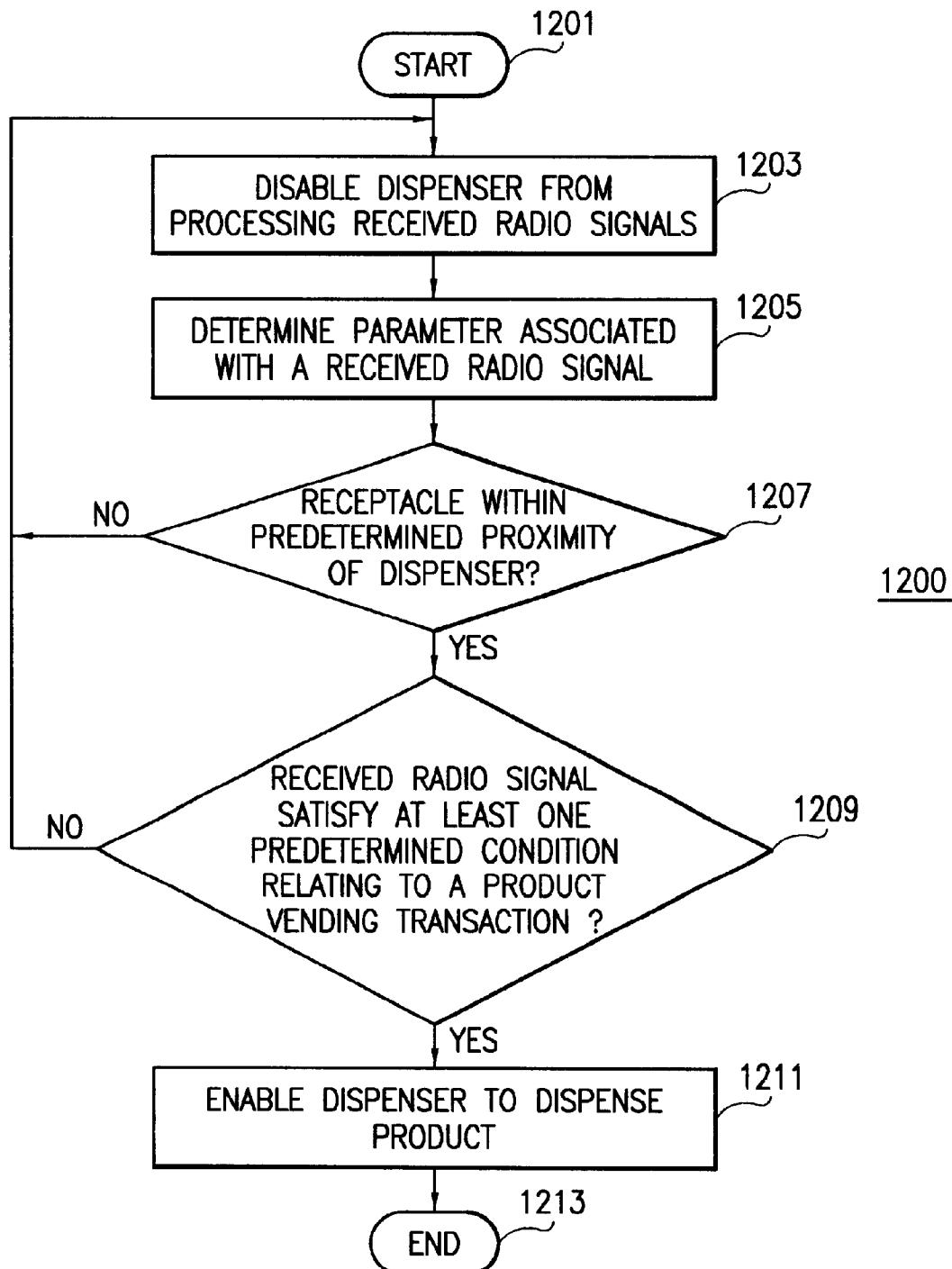


FIG. 12

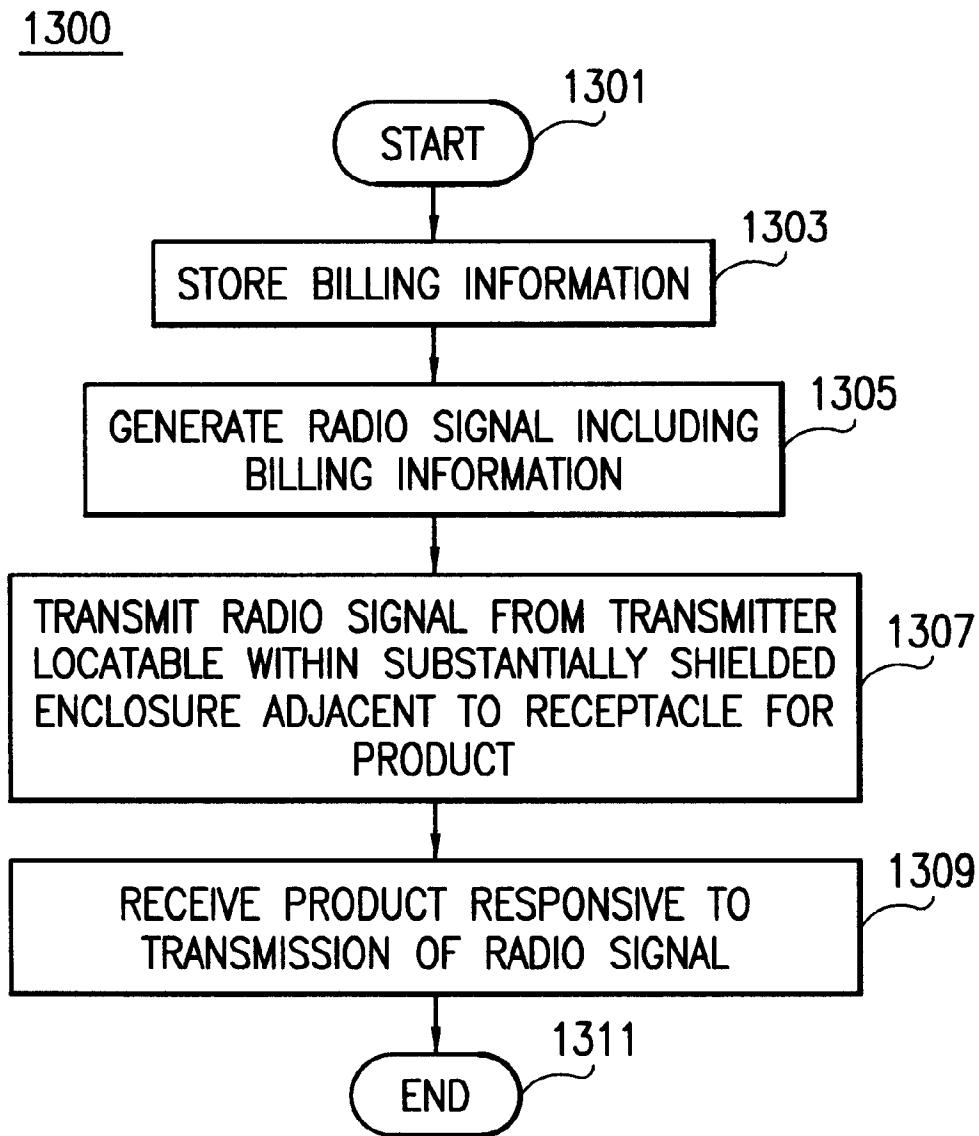


FIG. 13

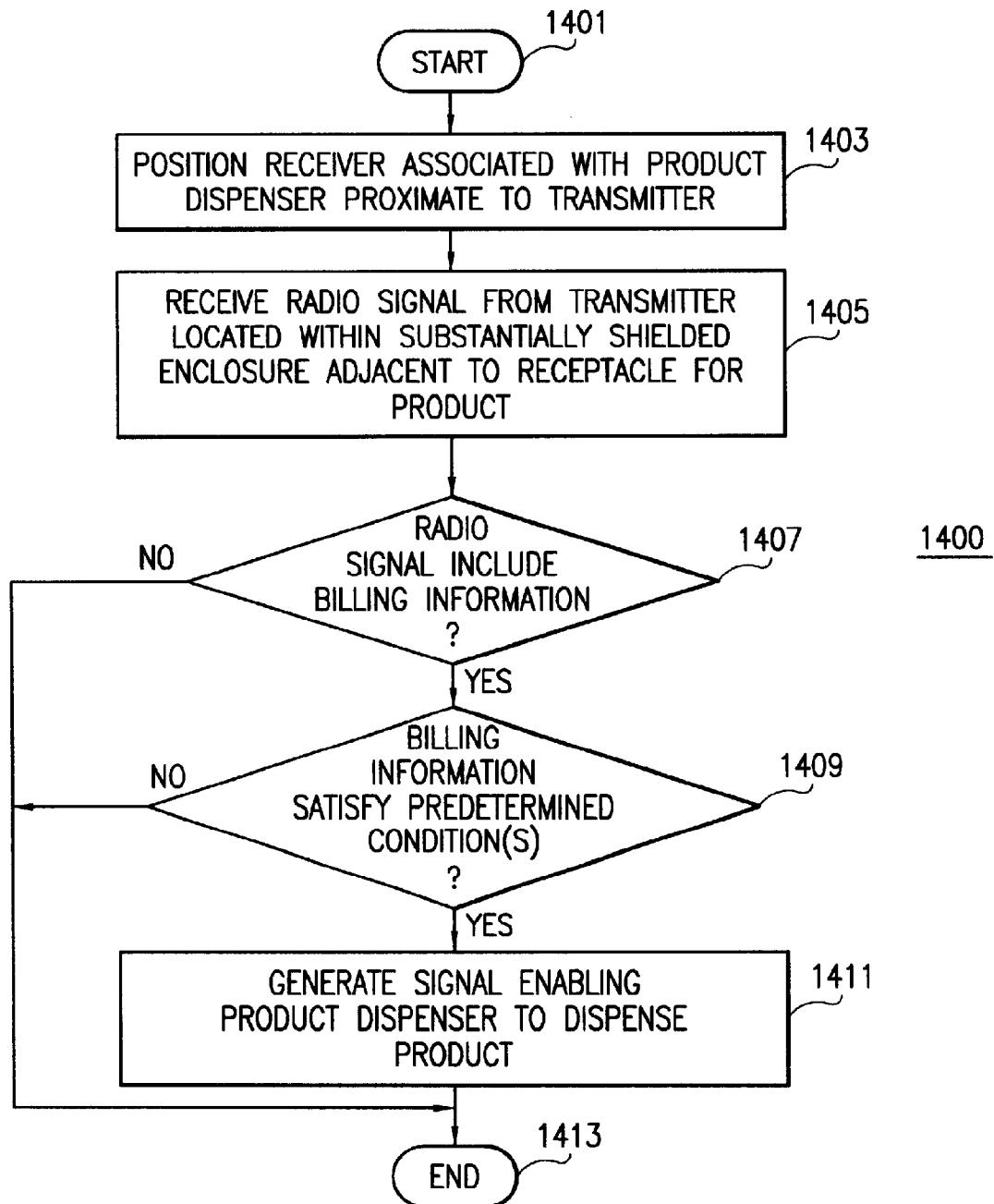
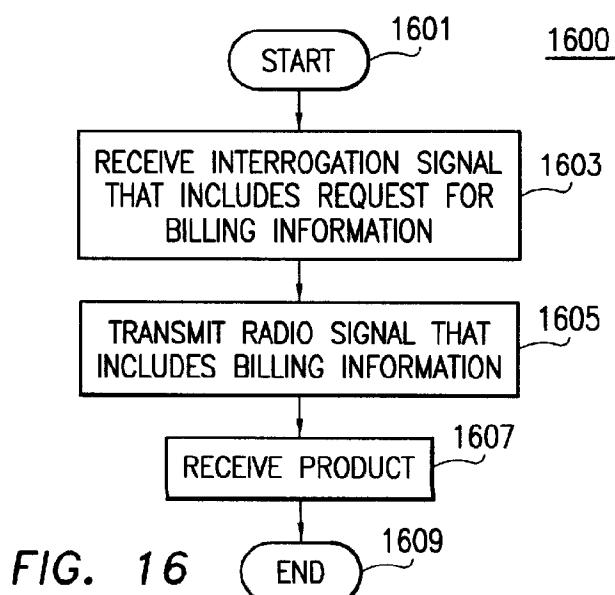
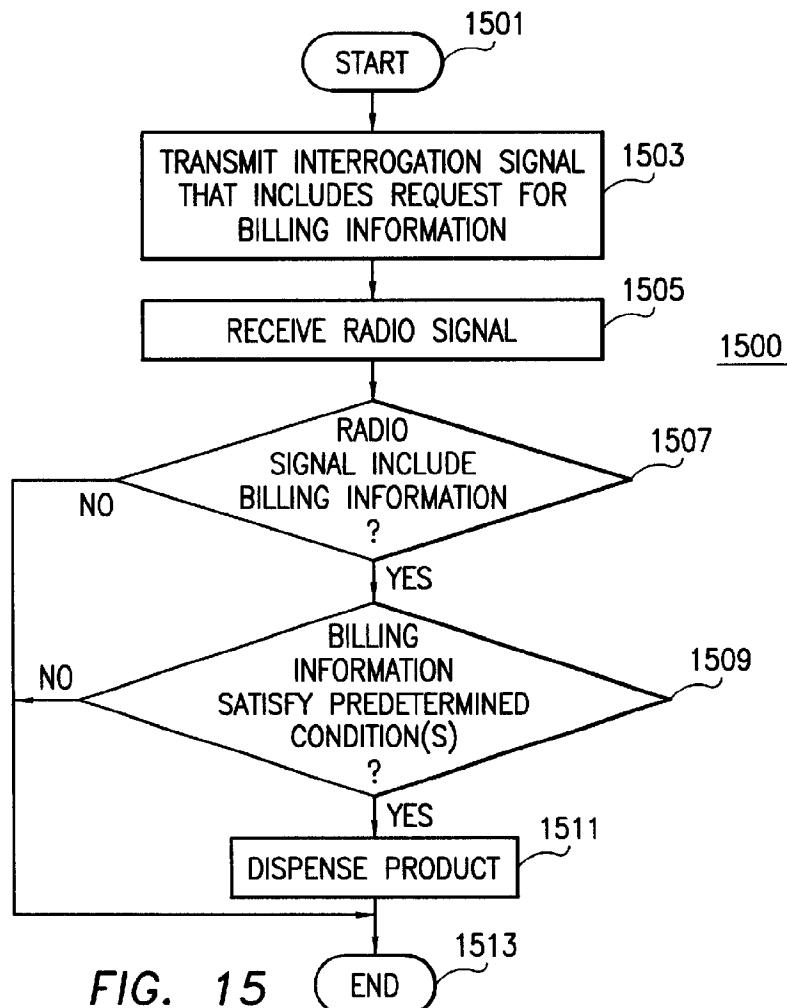


FIG. 14



**METHOD AND APPARATUS FOR
TRANSMITTING A DIGITAL INFORMATION
SIGNAL AND VENDING SYSTEM
INCORPORATING SAME**

**CROSS REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation-in-part of commonly-assigned U.S. patent application Ser. No. 08/956,732, filed Oct. 23, 1997, now U.S. Pat. No. 6,064,308 issued May 16, 2000 and claims benefit of Provisional Appl No. 60/029,464 filed Oct. 25, 1996 and No. 60/060,390 filed Sep. 29, 1997. A portion of the disclosure of this patent document contains material which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent disclosure, as it appears in the Patent and Trademark Office patent file or records, but otherwise reserves all copyright rights whatsoever.

Priority under 35 U.S.C. §119(e) is hereby claimed to co-pending, commonly-assigned U.S. Provisional Application No. 60/060,370, filed Sep. 29, 1997 and entitled "Apparatus and Method for Transmitting an Encoded Signal Through a Metallic Surface and Vending System Incorporating Same", which is expressly incorporated herein by reference in its entirety to form part of the present disclosure.

REFERENCE TO MICROFICHE APPENDIX

A portion of the disclosure of this patent document contains material which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent disclosure, as it appears in the Patent and Trademark Office patent file or records, but otherwise reserves all copyright rights whatsoever.

This disclosure includes a Microfiche Appendix containing computer program listings consisting in total of one (1) sheet of microfiche including eighty-two (82) total frames which are expressly incorporated herein by reference in their entirety to form part of the present disclosure.

1. Field of the Invention

The present invention relates generally to radio transmission systems and, in particular, to a method and apparatus for wirelessly transmitting digital information that may be employed in wireless point-of-sale vending systems, such as pay-at-the-pump fuel dispensing systems.

2. Background of the Disclosure

Reflecting an ongoing effort to provide retailers and others with a competitive advantage, various types of cashless vending systems are known in the art. For example, some vending machines are equipped with card reading devices that enable the machines to accept payments using credit cards and/or debit cards. The ability to accept cashless payments provides a number of important advantages. Vendors are able to make sales to persons who may not possess cash or coinage in necessary amounts or denominations and can gain access to valuable data on buying behaviors. Consumers benefit by being required to carry less cash and by being provided with complete records of card transactions by the card issuer. Unlike cash, which can also be lost or stolen, credit card users benefit from various laws intended to protect cardholders from unauthorized purchases and other forms of fraud involving their accounts. Card purchases may also afford the consumer access to discounts,

rebates, or other special incentive programs which are commonly linked to card usage.

In order to realize such advantages, it is known to provide fuel dispensers at filling stations with magnetic card reading devices for the purpose of accepting purchases to be charged to a credit or debit card account. One manufacturer of fuel dispensers, Gilbarco, Inc. of Greensboro, N.C., offers a card reading device under the trademark "CRIND" that includes a card receptacle to accept the magnetic card and also happens to accept cash. In addition to the advantages just noted, providing card reading devices directly at the "gas pump" allows customers to make their purchases quickly without the need to walk to a cashier (possibly subjecting one to inclement weather), wait in line, or count change.

In an effort to provide an even greater degree of speed and convenience to customers, one major oil company has recently introduced another system to facilitate the vending of fuel at filling stations. This system, which typically augments rather than replaces the magnetic card reading devices already present at the pump, is presently being promoted under the trademark "SPEEDPASS". The "SPEEDPASS" system is based on radio frequency identification (RFID) technology marketed by Texas Instruments under the trademark "TIRIS." "TIRIS" technology has also reportedly been employed to track items in a variety of material handling systems and to automatically assess tolls to vehicles on toll roads without the necessity of stopping the vehicle.

Customers interested in using the "SPEEDPASS" fuel vending system enroll by filling out a form that requests information identifying a credit card account to which purchases made using the system are to be posted. This credit card information is electronically encoded into a high frequency (2.45 GHz) radio frequency (RF) transponder device that is small enough to be attached to a key ring or carried in some other manner by the consumer to whom the device is issued. The fuel dispensers at participating filling stations are provided internally with a receiving unit having an antenna mounted beneath a designated area on the external surface of the dispenser. The designated area is prominently marked with identifying indicia and printed instructions for using the "SPEEDPASS" system. The instructions direct the consumer to bring the transponder device into proximity of the designated area. When this is done, the receiving unit within the dispenser picks up the encoded account information transmitted by the transponder device. Once the information is appropriately decoded, it is used to authorize a purchase and, at an appropriate time (such as on completion of the dispensing operation), to post relevant information relating to the purchase (such as the amount of the purchase, the time of day the purchase was made and the like) to the corresponding account of the customer. The purchase is subsequently reflected on an invoice or billing statement provided by the credit card company or other entity.

While systems, such as the "SPEEDPASS" system, may offer an incremental improvement in speed and convenience over use of a credit card, they also suffer certain drawbacks. Notably, if the transponder is lost or stolen, it can be used without authorization at any participating station. The use of off-the-shelf transponder devices may also present a security risk. Such risk may be reduced by encoding the transponder with a secondary account number that identifies, but does not actually represent, an actual credit card or debit account number. While secondary account encoding affords additional security, such an approach limits or complicates universal acceptance of the system by vendors other than the

issuer of the transponder due to the need to make available to other vendors a database cross referencing the actual and secondary account numbers. It is a disadvantage to the consumer to be limited to use of the system with only a single vendor. It is likewise undesirable to require a consumer to carry multiple transponders in order to make purchases from a corresponding multiple number of vendors.

Systems utilizing a high frequency RF carrier are also of limited utility due to problems associated with the electric field shielding effects of vehicle bodies and/or metallic structures used in and around fuel pumps. Such shielding effects require that the transponder units be located other than within electrically shielded areas and limit the effective range and/or reliability of signal transmission and/or reception. Such shielding problems are not satisfactorily addressed by attempts to locate the transponder or other signaling device at some secure, but inconspicuous, location on the exterior of a vehicle. In such a location, the signaling device would be exposed to harsh conditions including temperature and humidity extremes, precipitation, icing and an increased risk of damage from physical impact. Locating the device inside the compartment which houses the fuel cap of the vehicle would subject the device to the electric field shielding problems already noted.

Therefore, a need exists for a method and apparatus for transmitting a digital information signal that permit transmission of digital information (e.g., a credit card account number) from substantially electrically shielded environments, such as fuel cap compartments or automobile trunks, thereby facilitating temporary or permanent attachment of such an apparatus within electrically shielded environments, and that provides the flexibility necessary to permit a transmitter employing such a method to be used in vending systems of multiple vendors. A vending system that employs such a method and apparatus would also be an improvement over the prior art.

SUMMARY OF THE INVENTION

In view of the foregoing problems and limitations of the prior art, it is one object of the present invention to provide a transmission system for digital information that permits such digital information to be transmitted from a substantially electrically shielded environment. In one aspect of the present invention, a constant frequency generator generates a constant frequency signal, a phase modulator varies the instantaneous phase of the constant frequency signal based on the digital information, and a resonant circuit including an antenna averages the phase modulated signal to simulate a frequency modulated (FM) signal that includes the digital information. In another aspect of the present invention, the simulated FM signal is transmitted from the antenna primarily via a magnetic field at a carrier frequency of about ten kilohertz or less, thereby enabling the transmission of the digital information from an electrically shielded environment, such as from inside the trunk of an automobile. In a further aspect of the present invention, the phase modulator varies the instantaneous phase of the constant frequency signal by transitioning the constant frequency signal through at least two phases during any one bit transmission period to facilitate detection of the digital information using very low cost small scale integrated (SSI) circuits.

It is another object of the present invention to provide a product vending system in which the aforesaid method and apparatus may be utilized. The product vending system

preferably includes a card reading device that, in response to obtaining billing information for a consumer to be charged for the product, provides the billing information to a creditor of the consumer; a receiver for receiving a radio signal from a transmitter associated with a receptacle for the product; a card reader interface, operably coupled to the receiver and the card reading device, that determines whether the radio signal includes billing information for the consumer to be charged and, in response to determining that the radio signal includes the billing information, converts the billing information received from the receiver into a format compatible with the card reading device and generates a control signal to enable the product dispenser to dispense the product; and a transmitter, operably coupled to the card reader interface, that transmits, responsive to at least one control signal from the card reader interface, at least one interrogation signal that includes a request for the billing information.

It is a further object of the present invention to incorporate a jamming circuit into the product vending system, wherein the jamming circuit is coupled to the card reader interface and transmits a jamming signal to prevent the receiver from receiving the radio signal until at least a portion of the product dispenser is in sufficient proximity to the receptacle to permit reception of the radio signal.

It is yet another object of the present invention to provide a product vending system that utilizes half-duplex radio signaling to dispense a product from a dispenser to a receptacle for the product. Such a product vending system includes a transaction controller that generates control signals to facilitate dispensing of the product from the dispenser; a first transmitter, operably coupled to the transaction controller and forming a part of the dispenser, that transmits an interrogation signal responsive to a control signal from the transaction controller, the interrogation signal including a request for billing information of a consumer to be charged for the product; a first receiver, locatable in a substantially electrically shielded environment that is physically associated with the receptacle, that receives the interrogation signal; a second transmitter, operably coupled to the first receiver, that transmits a radio signal responsive to receipt of the interrogation signal, the radio signal including the billing information; and a second receiver, operably coupled to the transaction controller, that receives the radio signal, demodulates the radio signal to recover the billing information, and provides the billing information to the transaction controller.

These and other objects and advantages of the invention will become apparent to the person of ordinary skill in the art upon review of the following detailed description of a preferred embodiment taken in conjunction with the appended drawings in which like reference numerals designate like items.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial and block diagram depiction of a product vending system in accordance with a preferred embodiment of the present invention.

FIG. 2 is a block diagram depiction of the product vending system of FIG. 1.

FIG. 3 is a block diagram depiction of a preferred transceiver for the product vending system of FIG. 1.

FIG. 4 is a timing diagram of expanded time scale illustrating generation of a simulated FM signal by a transmitter portion of the transceiver of FIG. 3 and recovery of such simulated FM signal by a receiver portion of the transceiver of FIG. 3.

FIGS. 5A-5C together form a circuit schematic of a preferred embodiment of the transceiver of FIG. 3.

FIG. 6 is a block diagram depiction of a preferred transceiver for use with a product dispenser incorporated in the product vending system of FIG. 1.

FIG. 7 is a circuit schematic of a preferred embodiment of the transceiver of FIG. 6.

FIG. 8 is a block diagram of a jamming circuit in accordance with a preferred embodiment of the present invention.

FIG. 9 is a logic flow diagram illustrating steps executed by a card reader interface to generate a control signal to enable a vending machine to dispense a product in accordance with a preferred embodiment of the present invention.

FIG. 10 is a logic flow diagram illustrating steps executed by a transmitting device to transmit digital information, even from a substantially electrically shielded environment, in accordance with a preferred embodiment of the present invention.

FIG. 11 is a logic flow diagram illustrating steps executed by a receiving device to receive digital information transmitted, even from a substantially electrically shielded environment, in accordance with a preferred embodiment of the present invention.

FIG. 12 is a logic flow diagram illustrating steps executed by a product vending system to vend a product in accordance with the present invention.

FIG. 13 is a logic flow diagram illustrating steps executed to acquire a product from a vending device in accordance with the present invention.

FIG. 14 is a logic flow diagram illustrating steps executed in a product vending system to vend a product in accordance with the present invention.

FIG. 15 is a logic flow diagram illustrating steps executed by a product vending device to vend a product in accordance with a preferred embodiment of the present invention.

FIG. 16 is a logic flow diagram illustrating steps executed to acquire a product from a vending device in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Generally, the present invention encompasses a method and apparatus for transmitting a digital information signal and a vending system incorporating such a method and apparatus. In a preferred embodiment, a signal generator (e.g., an oscillator) generates a constant frequency signal. A phase modulator varies the instantaneous phase of the constant frequency signal to represent digital information, thereby producing a phase modulated signal. A tuned resonant circuit filters and averages the phase modulated signal to produce a simulated FM signal, and transmits the simulated FM signal via its antenna. One business transaction system (e.g., a vending system) incorporates such a transmitter to facilitate transmission of billing information from a device locatable within a substantially electrically shielded environment. Another business transaction system (e.g., a vending system, a material tracking system, or a highway toll system) preferably incorporates such a transmitter to facilitate half duplex transmission of digital information regardless of whether or not the digital information is transmitted from a device located within a substantially electrically shielded environment. By transmitting digital information in this manner and utilizing such a transmitter in a vending system, the present invention permits mounting of

the transmitter in a location where the transmitter may be hidden from view and is relatively physically secure from loss or theft, such as within a substantially electrically shielded enclosure (e.g., within the trunk or under the hood of an automobile), while allowing a consumer possessing such a fixed transmitter to engage in cashless business transactions, such as purchasing fuel for his or her vehicle or paying roadway usage fees. Thus, the present invention facilitates cashless and wireless vending transactions without requiring a consumer to carry (and potentially lose or have stolen) any RFID transmitter(s) because the transmitter of the present invention may be secured near a receptacle for a product, such as near the fuel inlet of a vehicle, for any consumer-selectable length of time.

The present invention can be more fully understood with reference to FIGS. 1-16. FIG. 1 is a pictorial depiction of a product vending system 10 in accordance with a preferred embodiment of the present invention. The preferred product vending system 10 is a fuel vending system and includes a product vending device 11 that dispenses a product (e.g., fuel) and a receptacle 51 for the product. In the preferred embodiment, the product vending device 11 includes a fuel pumping station 12, at least one hose 13 through which fuel from the fuel pumping station 12 flows, a card reading device 35, a transaction processor 30, and a disablement device 44. The hose 13 includes a dispenser 18 containing a nozzle 20 for directing the fuel into the receptacle 51 and a transceiver 22 (combination of transmitter and receiver) fitted with an antenna (not shown). The transceiver 22 is preferably constructed on a flat, ring-shaped printed circuit (PC) board, which board is mounted on the dispenser 18 inside a sealed cap, such that the nozzle protrudes through the hole in the ring-shaped PC board. The transceiver 22 is hard-wired to the transaction controller 30 via the hose 13 to receive direct current power and signaling instructions from the transaction controller 30. The architecture and operation of the transceiver 22 are discussed in more detail below. The fuel pumping station 12, the hose 13 (less any connection to the transceiver 22), and the dispenser (less the transceiver 22) may suitably comprise one of the "ADVANTAGE™" series of fuel dispensers available from Gilbarco, Inc. of Greensboro, N.C.

The card reading device 35 is connected to the transaction controller 30 (also referred to herein as a card reader interface) and preferably comprises a point of sale terminal, such as those that are commercially available from Gilbarco, Inc. under the trademark "CRIND." The card reading device 35 includes a card receptacle 32 for accepting credit cards, debit cards, and the like, and detecting the respective account information from the inserted card. The card reading device 35 may further include a display 31, a keypad 33, and a currency receptacle 34, although such elements do not form an integral part of the present invention.

The disablement device 44 may take the form of a limit switch or proximity detector that operates to selectively disable the transceiver 22 when the dispenser 18 is located in its nozzle boot 48. In the preferred embodiment, however, the disablement device 44 comprises a jamming circuit that operates under the control of the transaction controller 30 to transmit a jamming signal that prevents the transceiver 22 from receiving any other radio signals when the transceiver 22 is located in the physical vicinity of the disablement device 44. The disablement device 44 is preferably located near the portion of the product vending device 11 that retains the dispenser 18 until a consumer removes the dispenser 18 in anticipation of receiving the product. As shown, the disablement device 44 is preferably located near the nozzle

boot 48 in a fuel vending system. In an alternative embodiment, the disablement device 44 might comprise a logic circuit that generates a disable signal when the dispenser 18 is physically disposed within its nozzle boot 48 as sensed by a limit switch or a non-contact proximity detector. That is, instead of transmitting a jamming radio signal to prevent the transceiver 22 from receiving signals, the disablement circuit 44 might disable a portion (e.g., demodulator) of the transceiver 22 through application or removal of a voltage to or from a control section of the portion to be disabled.

The product receptacle 51 may be a stand-alone device, such as a gasoline can, or may form an integral part of a larger apparatus, such as the fuel inlet or fuel tank of a motorized vehicle 60, as shown in FIG. 1. In either case, a transceiver 50 is mounted, or otherwise attached, near (e.g., within one meter of) the receptacle 51 to facilitate radio communication with the transceiver 22 associated with the product dispenser 18 during the transaction. For example, when the receptacle 51 forms part of a motorized vehicle 60, the transceiver 50 may be mounted within a trunk 53 of the vehicle 60 directly above (i.e., adjacent to) the fuel inlet 50. In the alternative, the transceiver may be mounted on the fuel inlet access door 52 or at any other location in the proximity of the receptacle 50.

In the preferred embodiment, the consumer purchases or obtains the transceiver 50 from a vendor or a credit card or debit card issuer and mounts, or otherwise attaches, the transceiver 50 in a desired location (e.g., automobile trunk 53). The transceiver 50 is programmed to electronically store in memory the consumer's credit or debit card account information as well as any other desired billing-related information. Such programming may take place before, at, or after the time of issuance of the transceiver 50 to the consumer. The transceiver 50 is preferably battery-powered (e.g., using a lithium or other suitable battery exhibiting long shelf life and operating life) and packaged inside a sealed or molded plastic case or potting material or another suitable material. Consequently, in the preferred embodiment, the transceiver 50 is self-sufficient and does not require any electrical connections to the vehicle 60. Alternatively, the transceiver 50 may optionally be powered from the power supply associated with vehicle 60, either directly or through a charger coupled to a battery.

In order to program the transceiver 50 with account information, the account information is typically read from the magnetic stripe of a credit card using a conventional reading device. The data on the stripe typically contains a relatively high ratio of redundancy, which includes inefficient character encoding plus a parity bit for each digit (i.e., five bits of data per digit to represent the digits 0-9, which can be ideally represented using 3.32 bits/digit). This redundancy is preferably reduced or eliminated using any suitable data compression technique to compress the account number, the expiration date, and the extra data on track 2 of the magnetic stripe. The compression serves to reduce the number of bits required to be transmitted, and accordingly the transmission time, which prolongs battery life.

FIG. 2 is a block diagram depiction of the product vending system 10. As discussed above, the vending system 10 includes the transceivers 22, 50 and their associated antennas 209, 211, the dispenser 118, the hose 13, the card reader interface 30, the card reading device 35, the card receptacle 32, and the jamming circuit 44. Referring to FIGS. 1 and 2, operation of the product vending system 10 occurs substantially as follows in accordance with the present invention.

When a consumer desires to obtain a product, such as fuel, the consumer opens the fuel inlet access door 52, removes the fuel inlet cap (not shown), and removes the dispenser 18 from its retainer 48. In anticipation of a future fuel dispensing transaction, the card reader interface/transaction controller 30 periodically instructs the dispenser transceiver 22, preferably via a bi-directional data line connected to the hose 13, to determine whether a receptacle transceiver 50 is in sufficient proximity to the dispenser 18 to begin such a transaction. Depending on the type of fuel vending device 11, multiple dispensers might be employed (e.g., one dispenser for each grade of gasoline). Accordingly, the card reader interface 30 periodically instructs each connected dispenser transceiver 22 to determine whether a receptacle transceiver 50 is present. In the preferred embodiment, each dispenser transceiver 22 is instructed or polled once every N times 170 milliseconds to determine the presence of a receptacle transceiver 50, where N is the number of dispensers 18 that happen to be supported by the card reader interface 30.

When instructed to determine the presence of a receptacle transceiver 50, the dispenser transceiver 22 first transmits an interrogation signal requesting billing information for a consumer to be charged for the product. After transmitting the interrogation signal, the dispenser transceiver 22 receives signals for a predetermined time duration (e.g., a time duration associated with receiving eight bits) in an attempt to receive an acknowledgment of the interrogation signal. Once the receive cycle of a poll has completed, the received information (e.g., bits), if any, is correlated with the pre-established acknowledgment sequence in accordance with known techniques to determine whether a receptacle transceiver 50 is present. In the preferred embodiment, the received bits are also correlated with a jamming signal transmitted by the jamming circuit 44 during the polling cycle of the particular dispenser transceiver 22. The jamming signal comprises a frequency shift keying (FSK) encoded signal (jamming code 205) having a bit sequence that does not resemble a valid receptacle transceiver 50 response. The jamming code 205 is generated by the card reader interface 30 and is provided to the jamming circuit 44 for transmission. When bits received by the dispenser transceiver 22 correlate to the jamming code 205, the card reader interface 30 presumes that the dispenser 18 is still in its retainer 48 and no receptacle transceiver 50 is present. Thus, until an interrogation signal acknowledgment from the receptacle transceiver 50 is of a sufficient signal strength to dominate the jamming signal, the dispenser transceiver 22 will continue receiving the jamming signal and no dispensing will take place. Once the card reader interface 30 determines that a receptacle transceiver 50 is present, the card reader interface 30 preferably terminates the jamming code 207 temporarily until the transaction is completed.

Analogous to the preferred intermittent transmission of interrogation signals by the dispenser transceiver 22, the receptacle transceiver 50 preferably enables its receiver portion intermittently to receive interrogation signals. In the preferred embodiment, the receiver portion of the transceiver 50 is enabled intermittently at a duty cycle of approximately eighteen percent (18%) to save battery current.

When enabled, the receiver portion of the receptacle transceiver 50 receives signals and correlates the received signals with a predetermined interrogation signal sequence to determine whether an interrogation signal has been received. In the preferred embodiment, the receiver correlation circuit is designed such that the first three bits at the initiation of receive enable are used to seed a three bit maximal length sequence (MLS) generator. The MLS gen-

erator then generates the next bit in the sequence, which for proper correlation exactly matches the received bit. The MLS generation process continues until either the end of an interrogation sequence, as indicated by appropriate stop bits, or an inequality occurs. Once an inequality occurs or an end of interrogation is detected, the receiver portion of the receptacle transceiver 50 is disabled, sending the receptacle transceiver 50 to a low current drain state to conserve battery power and extend battery life.

In a purely random environment, where the probability of encountering a binary "zero" and a binary "one" are equally weighted, the average receiver enable duty cycle is given by the following equation:

$$\text{Duty cycle} = 0.5 * 4/22 + 0.25 * 5/22 + 0.125 * 6/22 + \dots$$

which yields an effective receiver duty cycle of 22.5 percent. Assuming that the disabled receiver draws negligible current, the operational life of the battery used to power the receptacle transceiver 50 can be extended by four times its continuous duty operational life. In the preferred embodiment, the periodic transmissions of interrogation signals by the dispenser transceiver 22 and the periodic enabling of the receiver portion of the receptacle transceiver 50 are appropriately phased, such that a receptacle transceiver 50 in a coverage area of the dispenser transceiver 22 will be detected by the dispenser transceiver 22 within one complete card reader interface polling cycle.

Thus, prior to and during the consumer's removal of the dispenser 18 from its retainer 48, the above-described intermittent interrogation signal transmissions occur without the consumer's knowledge. Once the dispenser transceiver 22 is positioned sufficiently close to the receptacle transceiver 50 to permit reception of the interrogation signal and the receptacle transceiver 50 acknowledges reception of the interrogation signal during a polling cycle of the dispenser transceiver 22, the receptacle transceiver 50 transmits billing information (e.g., a credit card or debit card account number, expiration date, creditor identification, or any other information stored by the issuer of the charge or debit account) to the dispenser transceiver 22 in the form of a radio signal 55. For security purposes, the billing information is preferably encrypted prior to transmission using any suitable encryption scheme, such as a common key scheme, of which many types offering excellent levels of security are well known to those skilled in the art. In addition, in the preferred embodiment, the receptacle transceiver 50 transmits the interrogation signal acknowledgment and the billing information via a magnetic field at a frequency of 8.192 kilohertz (kHz), in the manner described in U.S. patent application Ser. No. 08/956,732, which is hereby expressly incorporated herein by reference in its entirety to form part of the present disclosure. By using low frequency magnetic coupling to convey information instead of high frequency electromagnetic coupling, the receptacle transceiver 50 can be located within substantially electrically shielded environments physically associated with the receptacle 51 for the product, such as automobile trunks or automobile hoods, without substantially affecting transmission or reception.

Upon receiving the radio signal 55, the dispenser transceiver 22 demodulates, decodes, and decrypts the radio signal 55 to extract the digital information, if any, contained therein and provides the digital information to the card reader interface 30. The card reader interface 30 determines whether the digital information represents valid billing information for a consumer to be charged for the product. To make this determination, the card reader interface 30 performs some initial processing itself, such as executing one or

more known algorithms to test for a valid credit or debit card and examining the digits corresponding to the expiration date of the card to determine whether the expiration date associated with the billing information has passed. Upon completing this initial processing, the card reader interface 30 forwards the billing information to the appropriate creditor for authorization of the transaction. To accomplish such forwarding of the billing information, the card reader interface 30 emulates a credit or debit card swipe in the card receptacle 32 by converting the billing information into a format compatible with the card reading device 35 and providing the converted billing information 203 to the card reading device 35 on the same data bus as corresponding information is typically provided after a credit or debit card is swiped in the card receptacle 32. That is, the card reader interface 30 temporarily seizes the connection 207 between the card receptacle 32, exposed externally at the fuel vending device 11, and the internal electronics of the card reading device 35. The card reader interface 30 emulates the sequence of clock and data bits 201 ordinarily produced by a manual swipe of a credit or debit card. The internal interface electronic module of the card reading device 35, unaware that the transaction was initiated by the card reader interface 30, forwards the account information to a remotely-located Point of Sale (POS) computer (not shown), which responds with authorization approval or denial. Therefore, the present invention can be readily installed in existing fuel vending devices by simply installing the card reader interface 30 and the jamming circuit 44, and by connecting the card reader interface 30 in series with the data bus ordinarily connecting the card receptacle 32 to the card reading device 35.

Once the POS computer responds via the card reading device 35 authorizing the transaction, the card reader interface 30 releases the card receptacle control lines, allowing normal operation of the card receptacle and thereby effectively generating a control signal to enable the dispenser 18 to dispense the product. Upon completion of the dispensing operation, the POS computer debits the account identified in the billing information for the amount of the product purchase in accordance with known techniques.

As described above, the preferred embodiment of the present invention provides a vending system in which half-duplex transceivers associated with a product dispenser and a receptacle for the product are employed to facilitate point-of-sale billing without requiring any action by the consumer other than the consumer's normal positioning of the dispenser in or near the receptacle. By contrast, prior art fuel vending devices, such as those incorporating "SPEED-PASS" technology, require the consumer to carry a transponder containing the billing information and to position the transponder near a receiver on the fuel pumping station prior to removing the dispenser from its retainer and positioning the dispenser in or near the receptacle. Thus, the present invention eliminates the need to carry yet another device containing account information which can be lost or stolen at any time. In addition, the present invention utilizes efficient half-duplex transceivers to efficiently transmit billing information from the receptacle transceiver only when requested for it by the dispenser transceiver, thereby eliminating the need for the battery-operated receptacle transceiver to continuously transmit information and consume battery power. Still further, since only a common encryption key need be made available to other vendors, when encryption is used, the present invention can readily be implemented on a universally acceptable basis so that consumers are not limited to use of the system only for purchases from

a particular vendor, in sharp contrast to prior art systems, such as the "SPEEDPASS" system.

Although described above with reference to half-duplex operation of the transceivers 22, 50, the present invention is also applicable in a simplex communication environment. In such a system, a transmitter is mounted in the location of the receptacle transceiver 50 and a receiver is mounted in the location of the dispenser transceiver 22. The transmitter continually or periodically transmits the billing information in the form of a radio signal. The receiver continually or periodically receives signals and forwards the digital information contained in such signals to the card reader interface 30. However, for the reasons discussed above, simplex operation may be less favorable than half-duplex operation.

In addition to its application to the dispensing of fuel or any other product, the radio signal transmission method and apparatus of the present invention also has application to the tracking of inventory or to the transaction of other business, such as payment of road usage fees, in a wireless manner. In such non-product dispensing applications, the transmission technique employed in the preferred embodiment of the receptacle transceiver 50 and described in more detail below with respect to FIGS. 3-5 and 10 may be utilized to permit wireless transmission of billing information or inventory tracking numbers from battery-powered transceivers located in substantially electrically shielded enclosures, such as under automobile hoods, inside automobile trunks, or on medical, office or industrial equipment, where tracking assets is crucial, but where existing RF systems are unreliable due to electric field shielding effects.

FIG. 3 is a block diagram depiction of the preferred transceiver 50 for use near the fuel receptacle 51 in the product vending system 10 of FIG. 1. The transceiver 50 preferably operates in a half-duplex mode and includes a memory device 301 for storing digital information, such as billing information, a processor/data generator 303, a phase modulator 305, a tuned circuit 307, an antenna 309, a constant frequency generator 311, an amplifier 315, an FM demodulator 317, a lowpass filter 319, and a comparator 321. The memory device 301 preferably comprises read/write random access memory (RAM) that forms part of the processor/data generator 303. The preferred implementation of the remaining elements of the transceiver 50 are described in detail below with respect to the schematic depiction of such elements provided in FIG. 5.

Referring now to FIGS. 3 and 4, operation of the preferred receptacle transceiver 50 occurs substantially as follows in accordance with the present invention. During a dispenser transceiver polling cycle, the antenna 309 receives an interrogation signal via a radio channel 55 and passes the signal to the tuned circuit 307 for filtering and averaging. In the preferred embodiment, the interrogation signal is modulated in the dispenser transceiver 22 using FSK modulation. FSK modulation is preferably used in the dispenser transceiver 22 due to its ease of implementation in a high clock frequency integrated circuit (IC) and because the dispenser transceiver can be powered from a source other than a battery, such as a direct current source generated within the product vending device. Thus, the power requirements of the IC used to generate the FSK modulated signal are of less of a concern in the dispenser transceiver than are such power requirements in the battery-powered receptacle transceiver 50. By contrast, the preferred receptacle transceiver 50 utilizes low power, low clock frequency ICs, flip-flops, and NAND gates to create a simulated frequency modulated (FM) signal, as described below.

During receive mode, the phase modulator 305 and any other transmit amplifiers, if used, present a high impedance

(e.g., greater than ten times the input impedance of the receiver amplifier 315) to the received signal. Consequently, the tuned circuit 307 passes the averaged signal 329 to the receive path of the transceiver 50. The averaged signal 329 is amplified and leveled by the amplifier 315 to produce a constant envelope signal 330 and the constant envelope signal is provided to the FM demodulator 317. As is well known, an FM demodulator may be employed to demodulate an FSK-modulated signal because FSK modulation does not impart any information in the amplitude of the transmitted signal and the data may be recovered without resolving the actual phase of the recovered signal.

Upon receiving the constant envelope signal 330, the FM demodulator 317 recovers an analog representation of the transmitted bits by mixing the constant envelope signal 330 with a time-delayed version of itself in accordance with known delay discrimination techniques. In the preferred embodiment, the frequency of the received signal 329 is approximately 8.192 kHz and equals the frequency of the signal generated by the constant frequency generator 311. A frequency of about 10 kHz or less is selected to permit practical implementation of an antenna 309 that conveys and receives signals primarily via a magnetic field and, therefore, facilitates transmission of signals from within substantially electrically shielded enclosures. Such an antenna 309 is described in detail in commonly-assigned U.S. patent application Ser. No. 08/956,732, which is expressly incorporated herein by reference in its entirety to form part of the present disclosure.

The FM demodulator 317 provides the analog representation to the lowpass filter 319 for filtering and frequency spreading. The filtered representation is provided to the comparator 321, which compares the filtered representation with a preset analog signal to detect the transmitted bits and ultimately recover the transmitted data 323 (e.g., request for billing information). The request for billing information is then provided to the processor 303.

Upon recovering a bit sequence that corresponds to a request for billing information, the receptacle transceiver 50 begins the sequence of steps associated with transmitting the billing information. The processor/data generator 303 retrieves the data 323 corresponding to the billing information from the memory device 301 and instructs the phase modulator 305 to vary a phase of the constant frequency signal generated by the constant frequency generator 311 to produce a phase modulated signal 325 that represents the data. The microcontroller source code associated with operation of the processor 303, less any code related to encryption or decryption, is contained in the attached microfiche appendix.

In the preferred embodiment, the phase modulator 305 has four selectable phases (0 degrees, 90 degrees, 180 degrees, and 270 degrees) and transitions through two phases selected by the processor 303 during each bit transmission period to represent a particular bit of the data 323. It is well known that frequency modulation is mathematically equivalent to continuously modifying the instantaneous phase of a carrier frequency (fc), yielding the mathematical result for the instantaneous frequency:

$$f(t) = f_c + 1/(2\pi) * d\Phi/dt$$

where Φ is the instantaneous phase of the carrier frequency and t is time.

Thus, if, for example, one wished to represent a binary "one," which in the FM case might be represented by an instantaneous frequency greater than the carrier frequency,

an equivalent waveform can be generated by continuously and smoothly adding a positive offset to the phase of the carrier frequency. Similarly, a binary "zero" could be represented by continuously and smoothly subtracting a negative offset to the phase of the carrier frequency. Therefore, in this case, if one considers a phasor diagram with 0 degrees on the positive X-axis, 90 degrees on the positive Y-axis, 180 degrees on the negative X-axis, and 270 degrees on the negative Y-axis, a binary "one" might be denoted by a counterclockwise rotation of the phasor; whereas, a binary "zero" might be denoted by a clockwise rotation of the phasor, wherein the carrier frequency is denoted by no rotation. In an analogous manner, a binary "one" could be represented by an instantaneous frequency less than the carrier frequency and a binary "zero" could be represented by an instantaneous frequency greater than the carrier frequency. Consequently, in this case, a binary "one" might be denoted by a clockwise rotation of the phasor; whereas, a binary "zero" might be denoted by a counterclockwise rotation of the phasor. Therefore, instantaneous phase transitions applied by the phase modulator 305 result in a phase modulated signal 325 with instantaneous frequency changes that correspond to the bits of data 323. The number of phase transitions utilized to represent a particular bit is related to the average frequency deviation of the modulated signal.

As noted above, the processor 303 preferably instructs the phase modulator 305 to introduce two phase transitions per bit transmission period. However, because phase selection is instantaneous, each bit is represented by two abrupt 90-degree phase transitions, either clockwise or counterclockwise, instead of a smooth rotation of the phase of the constant frequency signal produced by the constant frequency generator 311. To account for such abrupt phase transitions, the phase modulated signal 325 is filtered and averaged by the tuned circuit 307 to produce a simulated FM signal 327. That is, the output of the tuned circuit 307 is not a true FM signal, but rather approximates an FM signal waveform. In the preferred embodiment, additional filtering and averaging occurs in the dispenser transceiver 22 as described below to produce a signal that more closely approximates an FM signal prior to demodulation. However, in an alternative embodiment, all such filtering and averaging may be included in the transmit portion of the receptacle transceiver 50.

Further understanding of the aforesaid phase modulation approach can be gained by referring to FIG. 4, which is a timing diagram of expanded time scale illustrating generation and recovery of the simulated FM signal. Starting at the top of FIG. 4, the first timing diagram depicts exemplary data 323 retrieved from the memory device 303. In this example, the data consists of the bit sequence "00101101". Each bit has a respective bit transmission time of Δt .

The second diagram depicts the preferred phase transitions of the constant or carrier frequency signal introduced by the phase modulator 305 to represent the data 323 in response to instruction from the processor 303. Thus, the second diagram illustrates the phase of the phase modulated signal 325 during each bit transmission period. As shown by the diagram, a binary "zero" is represented by two clockwise phase transitions (e.g., from 0 degrees to 270 degrees and then from 270 degrees to 180 degrees); whereas a binary "one" is represented by two counterclockwise phase transitions (e.g., from 180 degrees to 270 degrees and then from 270 degrees to 0 degrees).

The instantaneous frequency of the phase modulated signal 325 at each phase transition is depicted in the third diagram. The instantaneous frequency can be shown math-

ematically to be an impulse of either positive or negative polarity corresponding to a positive or negative phase transition. However, such a waveform of impulses has little value as an FM waveform because the FM component is too narrow to measure accurately. Thus, the FM impulses must be broadened or spread in time to be effective.

Broadening of the instantaneous frequency waveform is depicted in the fourth diagram through illustration of the instantaneous frequency of the tuned circuit output signal 327. The bandpass response of the tuned circuit 307 spreads the FM impulses in time, thereby producing a simulated FM signal that is detectable. Additional filtering further spreads the FM impulses in time as depicted in the fifth diagram. As noted above and discussed in more detail below, the additional filtering is preferably provided in the dispenser transceiver 22, although such filtering could alternatively be added to the transmit portion of the receptacle transceiver 50. The two remaining diagrams depict the recovered FM and data, and will be discussed in more detail below with respect to FIG. 6.

FIGS. 5A-5C together form a circuit schematic of a preferred embodiment of the receptacle transceiver 50 of FIG. 3. The preferred transceiver comprises a plurality of resistors 501-525, a plurality of capacitors 530-544, a plurality of transistors 551-556, a transformer 558, a diode 559, a plurality of NAND gates 561-564, a piezoelectric crystal 566, a plurality of flip-flops 571-576, a microcontroller 582, and two microcircuits 581, 583. The microcontroller 582 functions as the processor 303 and the memory device 301. The phase modulator 305 comprises microcircuit 581, which is a data selector that selects a single clock phase for transmission, according to a prescribed format, in an algorithm contained within the microcontroller 582.

The constant frequency generator 311 comprises an oscillator and the circuit including flip-flops 571-573. The oscillator is formed using a conventional tuning fork style piezoelectric crystal 566, two resistors 516, 517, proper loading capacitors 539, 540, and a conventional oscillator gate 561 as is well known in microelectronic designs. The oscillator provides a uniform clock waveform at 32,768 kHz having exceptional accuracy due to the crystal 566. The clock and integer subharmonic frequencies are utilized to provide the timebase for receptacle transceiver timing, synchronous clocking of processor state machines, and stimulus for a timer circuit internal to the microcontroller 582. The flip-flops 571-573 synthesize four clock phases of 8.192 kHz, which are applied for selection by the phase modulator 305.

The tuned circuit 307 comprises a resonant circuit and a driver circuit. The resonant circuit is formed from resistor 515, capacitors 537 and 538, transformer 558, and diode 559. The resonant circuit includes the antenna 309, which is formed by the transformer 558. The driver circuit comprises gates 562-564, metal oxide semiconductor (MOS) field effect transistor 554, resistor 518, and capacitor 541. Details of the operation of the tuned circuit 307 can be found in U.S. patent application Ser. No. 08/956,732, which is incorporated herein by reference.

The receiver amplifier 315 is formed from the combination of resistors 501-514, capacitors 530-536, and transistors 551-553. The FM demodulator 317 receives its input from the receiver amplifier 315 (see RCVRF port) and is formed using very inexpensive small scale integrated (SSI) microcircuits. The devices are low power, low cost complementary MOS devices, which enable the invention to be implemented conveniently and at low cost. Thus, as shown, the FM demodulator 317 includes flip-flops 574-576 and microcircuit 583.

The receiver lowpass filter 319 constitutes an active filter comprising resistors 519-521, capacitors 542-544, and transistor 555. Finally, the comparator 321 includes resistors 522-525 and transistor 556. Table 1 below is a parts listing for the transceiver 50 of FIGS. 5A-5C. In the preferred embodiment, all elements of the transceiver 50, with the exception of the crystal 566 and all the elements forming the receiver amplifier 315, the tuned circuit 307, and the antenna 309, are implemented within an application specific integrated circuit (ASIC).

TABLE 1

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
516	10 MΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-106
517	470 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-474
509, 511, 513, 522	1 MΩ resistor	4	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-105
518	220 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-224
515	22 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-223
514	10 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-103
502, 504, 506	2 MΩ resistor	3	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-205
507	1 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-102
512	82 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-823
505	200 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-204
508, 510	150 kΩ resistor	2	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-154
501, 503	430 kΩ resistor	2	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-434
519-521	330 kΩ resistor	3	Panasonic Industrial Co. (Div. Of Matsushita Electric	ERJ-6GEYJ-334

TABLE 1-continued

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
5			Corp. of America) (Secaucus, NY).	
524	510 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-514
10			Corp. of America) (Secaucus, NY).	
525	750 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-754
15			Corp. of America) (Secaucus, NY).	
523	22 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-6GEYJ-223
20			Corp. of America) (Secaucus, NY).	
539	5 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE5R1D-2NO
540	20 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE200J-2NO
25			Corp. of America) (Secaucus, NY).	
541	68 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE680J-2NO
30			Corp. of America) (Secaucus, NY).	
531, 533, 535	0.1 μF capacitor	3	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE104M-2NU
35			Corp. of America) (Secaucus, NY).	
538	0.01 μF capacitor	1	NIC Components Corp. (Amityville, NY)	NSPC103J50-TRB2
35			Corp. of America) (Secaucus, NY).	
537	3300 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE332J-3NO
35			Corp. of America) (Secaucus, NY).	
532, 534, 536	1000 pF capacitor	3	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE102-K2NR
40			Corp. of America) (Secaucus, NY).	
530	10 μF capacitor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ECS-TOJY-106R
45			Corp. of America) (Secaucus, NY).	
542	6800 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE682-K2NR
50			Corp. of America) (Secaucus, NY).	
543	0.01 μF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE103-K2NR
50			Corp. of America) (Secaucus, NY).	
544	1800 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE182-K2NR
55			Corp. of America) (Secaucus, NY).	
559	Switching diode	1	Zetex, Inc. (Commack, NY)	FMMD914
551-553, 555-556	NPN transistor	5	ROHM Co., Ltd. (Antioch, TN)	MMST5089
554	N-Channel MOSFET	1	Digi-key (Fairchild)	NDS351-NCT-ND
60			Corp. of America) (Secaucus, NY).	
558	Transistor/antenna	1	Pole Zero Corp. (West Chester, Ohio)	See U.S. patent application Ser. No. 08/956,732
566	Watch crystal	1	Raltron (Miami, FL)	R38-32,768-KHz
561-564	Quad 2-In	1	National	CD4011BCM
65	NAND	1	Semiconductor Corp. (Santa Clara, CA)	

TABLE 1-continued

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
571-576	Dual D Flip Flop	3	National Semiconductor Corp. (Santa Clara, CA)	CD4013BCM
583	18-Bit State Shift Register	1	SGS Thomson	4006BM
582	Processor	1	Microchip Technology, Inc. (Chandler, AZ)	PIC16LC71-04I/SO
581	Mux/ Demux	1	National Semiconductor Corp. (Santa Clara, CA)	CD4052BCM

FIG. 6 is a block diagram depiction of a preferred transceiver 22 for use with a product dispenser 18 incorporated in the product vending system 10 of FIG. 1. The dispenser transceiver 22 includes an FSK modulator 601, an oscillator 603, a tuned circuit 607, an antenna 609, a receiver amplifier 613, an FM demodulator 615, a lowpass filter 617, and a comparator 619. In the preferred embodiment, most of the transceiver circuitry resides in a microprocessor as described below with respect to FIG. 7.

Upon instruction from the transaction controller 30 via a data bus coupled to the dispensing hose 13 (e.g., during a dispenser transceiver polling cycle), the FSK modulator 601 modulates a carrier frequency generated by the oscillator 603 to represent the data (e.g., an interrogation signal) provided by the transaction controller 30. The FSK-modulated signal is then applied to the tuned circuit 607 and antenna 609 for transmission as a radio signal 55. The tuned circuit 607 and antenna 609 preferably comprise elements substantially similar to the tuned circuit 307 and antenna 309 of the receptacle transceiver 50, except that the antenna 309 of the dispenser transceiver 22 is preferably divided into two antenna elements, as shown in FIG. 7 and discussed in more detail below.

If a receptacle transceiver (e.g., receptacle transceiver 50) receives the interrogation signal and responds thereto, the dispenser receiver 22 receives billing information from the receptacle transceiver in the form of a radio signal 55. The antenna 609 receives the billing information signal and provides it to the tuned circuit 607. As discussed above, the billing information signal preferably constitutes a simulated FM signal. The tuned circuit 607 filters and averages the received signal to produce a signal 621 that further emulates an FM signal. Referring back to FIG. 4, the instantaneous frequency of signal 621 is depicted in the fifth diagram from the top. Thus, the receiving antenna 609 and the tuned circuit 607 further spread the transmitted signal to simulate an FM waveform. The simulated FM signal is amplified and leveled by the receiver amplifier 613 to produce a constant envelope signal at a frequency of the oscillator 603 that is applied to the FM demodulator 615. The FM demodulator converts the FM signal 621 to baseband and provides the baseband signal to the lowpass filter 617 (e.g., a 3-pole Butterworth filter). The lowpass filter 617 reconstructs the FM waveform 623, such that a simple magnitude comparator 619 may be used to reconstruct the original data waveform 625. The reconstructed FM waveform 623 and the recovered data 625 are depicted in FIG. 4 as the bottom two diagrams, respectively. It should be noted that time delays associated with filtering, transmission, and other processing are excluded from the timing diagrams of FIG. 4 for the purpose of clarity.

FIG. 7 is a circuit schematic of a preferred embodiment of the dispenser transceiver 22 of FIG. 6. The preferred transceiver 22 comprises a plurality of resistors 701-730, a plurality of capacitors 741-759, a plurality of transistors 781-784, two inductors 771, 772, two operational amplifiers 791, 792, a piezoelectric crystal 797, and a microcontroller 795. The microcontroller 795 functions as the FSK modulator 601, the FM demodulator 615, the lowpass filter 617, and the comparator 619. The source code for the microcontroller 795, less any code related to encryption or decryption, is provided in the attached microfiche appendix.

The oscillator 603 is formed using a conventional 10 MHz piezoelectric crystal 797, one resistor 730, proper loading capacitors 758, 759, and a conventional oscillator gate (contained in the microcontroller 795) as is well known in microelectronic designs. The oscillator 603 provides a uniform clock waveform at a carrier frequency of 10 MHz having exceptional accuracy due to the crystal 797. The carrier and integer subharmonic frequencies are utilized to provide the timebase for dispenser transceiver timing and synchronous clocking of microcontroller state machines.

The tuned circuit 607 comprises a resonant circuit and a driver circuit. The resonant circuit is formed from resistor 701, capacitors 741-743, and inductors 771, 772. The resonant circuit includes the antenna 609, which is formed by the two inductors 771, 772. The driver circuit comprises MOSFET transistor 784, resistors 728 and 729, capacitor 757, and NAND gates that are resident in the microcontroller 795. Operation of the tuned circuit 607 is provided in detail in commonly-assigned U.S. patent application Ser. No. 08/956,732, which is incorporated herein by reference. The receiver amplifier 613 is formed from the combination of resistors 702-727, capacitors 744-756, transistors 781-783, and operational amplifiers 791 and 792.

Table 2 below is a parts listing for the preferred transceiver 22 of FIGS. 7A-7B. In the preferred embodiment, all elements of the transceiver 22, with the exception of the crystal 797 and all the elements forming the receiver amplifier 613, the tuned circuit 607, and the antenna 609, are implemented within an ASIC.

TABLE 2

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
701	33 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-333
703, 708, 724	560 kΩ resistor	3	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-564
726	300 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-303
709, 711	330 kΩ resistor	2	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-365YJ-334
705	200 kΩ resistor	1	Panasonic Industrial Co. (Div.	ERJ-3GSYJ-204

TABLE 2-continued

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
710	82 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-823
702	18 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-183
718, 728	100 Ω resistor	2	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-101
713, 717	360 kΩ resistor	2	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-364
714	820 Ω resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-821
715	200 Ω potentiometer	1	Digi-Key	P1S201CT
707	6.8 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-682
727	2.2 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-222
716	680 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-684
719, 721, 729	100 kΩ resistor	3	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-104
720	39 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-393
712	8.2 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-822
706	1.2 kΩ resistor	1	Of Matsushita Electric Corp. of America (Secaucus, NY). Panasonic Industrial Co. (Div.	ERJ-3GSYJ-122

TABLE 2-continued

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
725	20 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-203
723	5.1 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-512
730	10 Ω resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-100
722	120 kΩ resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-124
704	220 Ω resistor	1	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ERJ-3GSYJ-221
744, 746, 749, 754	1000 pF capacitor	4	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE102K1-NRT1
741	0.01 μF capacitor	1	NIC Components Corp. (Amityville, NY)	NSPC103J50-TRB2
742	3900 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE392J-4NO
747, 748, 750, 755, 756	3.3 μF capacitor	5	KEMET	T491A335K0-10AS
745, 760,	0.1 μF capacitor	2	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE104M-2NU
753	22 μF capacitor	1	KEMET	T491C226K0-10AS
751, 752	1000 pF capacitor	2	Panasonic Industrial Co. (Div. Of Matsushita Electric Corp. of America) (Secaucus, NY).	ECU-V1H102JCX
758	39 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE390J-1NOT1
759, 743	27 pF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE270J-1NOT1
757	0.01 μF capacitor	1	Surface Mountable Electronic Components, Inc. (Austin, TX)	MCCE103-K2NR
771	12 μH inductor	1	Pole Zero Corp. (West Chester, OH)	

TABLE 2-continued

Reference Numeral(s)	Description	Quantity	Manufacturer	Manufacturer's Part Number
772	Inductor with wire secondary	1	Pole Zero Corp. (West Chester, OH)	
781-783	NPN transistor	3	ROHM Co., Ltd. (Antioch, TN)	MMST5089
784	N-Channel MOSFET	1	Digi-key (Fairchild)	NDS351-NCT-ND
797	10 MHz crystal	1	ECS, Inc.	ECS-100-S-5P
795	8 bit Micro-controller	1	Microchip Technology, Inc. (Chandler, AZ)	PIC16F84-101/SO
791, 791	Dual Operational Amplifier	1	Texas Instruments	TLC2272

FIG. 8 is a block diagram of a jamming circuit 44 in accordance with a preferred embodiment of the present invention. The jamming circuit 44 includes an amplifier 801, a tuned circuit 803, and an antenna 805, and is preferably affixed in proximity to the dispenser retainer (e.g., nozzle boot). The amplifier 801 amplifies an input signal 205 representing a jamming code bit sequence received from the transaction controller (card reader interface). The input signal 205 is at a receive frequency of the dispenser transceiver.

The tuned circuit 803 preferably comprises the necessary capacitors, inductors, and resistors to facilitate transmission of the amplified jamming signal. In the preferred embodiment, a single inductor of the tuned circuit 803 serves as the antenna 809. In an alternative embodiment, a resonant circuit, such as the circuit described in detail in U.S. patent application Ser. No. 08/956,732, may be employed as the combination of the tuned circuit 803 and the antenna 805.

The jamming circuit 44 serves two functions. First, the jamming circuit 44 serves to indicate to the associated card reader interface that the dispenser 18 has been returned to the retainer, signaling the completion of a vending transaction. This indication is accomplished through the dispenser transceiver's reception of a unique bit sequence (jamming code) transmitted only by the jamming circuit 44, and not by any receptacle transceiver 50. Second, the jamming circuit 44 functions as a disablement device for the receive portion of the dispenser transceiver 22 when the dispenser 18 is placed in its retainer (e.g., nozzle boot 48) and no vending transaction is taking place. The disablement occurs as a result of the jamming circuit 44 radio emissions dominating the receive portion of the dispenser transceiver 22. Such disabling of the receive portion of the dispenser transceiver 22 is desired to prevent the dispenser transceiver 22 from erroneously receiving billing information from other receptacle transceivers 50 that may either be engaged in vending transactions with other dispenser transceivers 22 or be periodically transmitting from vehicles that are simply passing or are parked nearby the vending machine.

FIG. 9 is a logic flow diagram 900 illustrating steps executed by a card reader interface 30 to generate a control signal to enable a vending machine to dispense a product in accordance with a preferred embodiment of the present invention. The card reader interface 30 masters the control of the vending transaction in a fixed sequence that is

programmed into a microcontroller. Microcontroller source code, less decryption routines, that may be executed by the card reader interface 30 to perform the logic flow depicted in FIG. 9 is contained in the attached microfiche appendix and is incorporated into the present specification as if fully set forth herein.

The logic flow begins (901) when, upon power up of the card reader interface microcontroller, the card reader interface 30 initializes (903) itself, including its ports and internal variables. After initializing itself, the card reader interface 30 initializes (905) each dispenser transceiver 22 that it controls. The card reader interface 30 conveys a stimulus, in sequential order, to each dispenser transceiver 22. Upon proper response by a dispenser transceiver 22 to the stimulus, the card reader interface 30 identifies the dispenser transceiver 22 as being active, and initializes appropriate constants, if applicable, in the dispenser transceiver 22 via a command process. For example, the card reader interface 30 might convey timing parameter constants to the dispenser transceiver 22 during the initialization phase.

After all active dispenser transceivers 22 have been initialized, the card reader interface 30 enters its normal mode of operation and performs the steps depicted in blocks 907-931. During its normal mode of operation, the card reader interface 30 enters into a polling cycle with respect to each dispenser transceiver 22. That is, the card reader interface 30 polls (907) a first dispenser transceiver and determines (909) whether a receptacle transceiver 50 is present. The polling command instructs the dispenser transceiver 22 to transmit an interrogation signal during a first time period (e.g., 135 milliseconds) and, upon termination of the first time period, receive signals, such as an acknowledgment of receipt of the interrogation signal, during a second time period (e.g., 35 milliseconds). Upon expiration of the second time period, the dispenser transceiver 22 demodulates the received signals to recover any received data and forwards the data to the card reader interface 30. The card reader interface 30 then correlates the received data with a predetermined acknowledgment sequence to determine whether an acknowledgment was received and, therefore, whether a receptacle transceiver 50 is present.

If no receptacle transceiver is present in the coverage area of the first dispenser transceiver 22, the card reader interface 30 sequentially polls (925, 929) each other dispenser transceiver 22 in a similar manner. If no receptacle transceiver 50 is present at any of the dispenser transceivers 22, the polling process restarts at block 907. However, if a receptacle transceiver 50 is determined (909, 927, 931) to be present during any polling cycle, the card reader interface 30 commences communication with the respective receptacle transceiver 50, which, at a minimum, encompasses initializing (911) a download of billing information (e.g., credit or debit card account number) for a consumer to be charged for the product from the receptacle transceiver 50, for example by deactivating jamming circuit 44 transmissions to improve the environment for dispenser transceiver reception or transmitting a predetermined query sequence, and receiving (913) the billing information. In the preferred embodiment, the card reader interface 30 and the receptacle transceiver 50 enter into a communications protocol via the dispenser transceiver 22, which protocol includes exchanging encrypted data, data parity checks, and acknowledgment handshaking.

Upon receiving the billing information, the card reader interface 30 decompresses and decodes (915) the account number and reformats it for transmission to the vending site card reading device 35 or Point of Sale (POS) computer. In

the preferred embodiment, the receptacle transceiver 50 compresses the billing information prior to transmission to enable such information to be transmitted in a shorter period of time, thereby saving battery life. To compress the billing information, the receptacle transceiver 50 preferably represents a group of digits by a single binary symbol in accordance with known techniques, thereby making more efficient use of binary symbols. After extracting the account information, the card reader interface 30 seizes (917) control of the card receptacle 32 control lines utilizing a multiplexer and conveys the account information to the POS computer using a format that emulates (919) a manual swipe of a customer's credit or debit card in the card receptacle 32.

Once the account information has been reliably conveyed to the POS processor and authorization for the transaction has been received, the card reader interface releases (921) the card receptacle control lines, allowing normal operation of the card receptacle and thereby effectively generating a control signal enabling the dispenser to dispense the product. That is, in the preferred embodiment, the card reader interface 30 provides a stimulus (account information) for allowing the card reading device 35 and its associated circuitry to engage in normal routines to interact with the vending device's conventional dispensing control electronics and valving (not shown) to either enable or disable dispensing. Thus, in the preferred embodiment, the card reader interface indirectly enables or disables dispensing of the product. In an alternative embodiment, upon receiving authorization for the transaction from the POS computer, the card reader interface 30 might directly interact with the vending device's conventional dispensing control electronics and valving to enable or disable dispensing.

After completion of the billing information transfer, the card reader interface 30 may engage in one or more of a variety of activities, such as ceasing communication with the receptacle transceiver 50 or continuing communication with the receptacle transceiver 50 for the purpose of affirming the proximity of the receptacle transceiver 50, uploading additional information (e.g., a new account number) to the receptacle transceiver 50, or downloading information from the receptacle transceiver 50.

After the card reader interface 30 has ceased communication with the receptacle transceiver 50, the card reader interface 30 determines (923) whether a jamming circuit 44 is proximate. That is, the card reader interface 30 provides the jamming code to the jamming circuit 44 for transmission, if the card reader interface 30 had previously removed such code, and determines whether the dispenser transceiver 22 has received the jamming signal to indicate that the dispenser 18 has been returned to its retainer (e.g., nozzle boot 48). When no jamming signal is detected, the card reader interface 30 continues searching for such a signal. When a jamming signal is detected, the card reader interface 30 acknowledges completion of the vending transaction and resumes execution the dispenser transceiver 50 polling cycles as described above.

In addition to the circuitry and system blocks discussed above with respect to FIGS. 2-9, the preferred vending system also includes an intrinsic safety circuit (not shown) utilized in the cable connection between the card reader interface 30 and the dispenser transceiver 22. The intrinsic safety circuit is designed to meet requirements set forth by the Underwriters Laboratories which prescribe the measures to be taken to ensure intrinsic safety of electrical devices in a fuel dispenser. The intrinsic safety requirements provide for voltage and current limiting on any electrical conductor that enters or passes through the designated fuel vapor

region(s) of a fuel dispenser. The intrinsic safety circuitry is well known in the art and fundamentally comprises a circuit containing shunt diodes for voltage limiting and series resistors and/or fuses for current limiting.

FIG. 10 is a logic flow diagram 1000 illustrating steps executed by a transmitting device to transmit digital information from a substantially electrically shielded enclosure, or other substantially electrically shielded environment, in accordance with a preferred embodiment of the present invention. The logic flow begins (1001) when the transmitting device generates (1003) a constant frequency signal. In the preferred embodiment, the constant frequency signal is a sinusoid at a frequency of approximately 8.192 kilohertz. However, any constant frequency signal having a center frequency of about ten kilohertz or less may be used.

Once the constant frequency signal is generated, the transmitting device phase modulates (1005) the constant frequency signal to represent digital information to be transmitted. That is, the transmitting device varies an instantaneous phase of the constant frequency signal over a period of time to represent the digital information to be transmitted. In the preferred embodiment, the transmitting device applies two phase transitions during any one bit transmission period to represent a bit of digital information. Accordingly, the transmitting device transitions the phase of the constant frequency signal from a first phase (e.g., 0 degrees) to a second phase (e.g., 270 degrees) during a first portion (e.g., first half) of the bit transmission period and then transitions the phase of the constant frequency signal from the second phase (270 degrees) to a third phase (e.g., 180 degrees) during a second portion (e.g., second half) of the bit transmission time period. In the preferred embodiment, the transmitting device represents a binary "zero" by transitioning the phase of the constant frequency signal in a clockwise direction (with respect to a phasor representation of the constant frequency signal) through two phase transitions per bit transmission time period. Similarly, in the preferred embodiment, the transmitting device represents a binary "one" by transitioning the phase of the constant frequency signal counterclockwise through two phase transitions per bit transmission time period. In an alternative embodiment, the transmitting device may transition the phase of the constant frequency signal through more than two phase transitions during any one bit transmission time period to represent the respective bit to ultimately be transmitted. The number of phase transitions during any particular bit transmission period is determined based on the amount of subsequent filtering and averaging employed to disperse the FM impulse response resulting from the instantaneous phase transitions, and the effective FM deviation desired. In the preferred embodiment, two phase transitions were found to be sufficient when both the transmitting device and the receiving device incorporated the aforementioned tuned resonant circuits to average and spread the frequency response.

Once the phase modulated signal is produced, the transmitting device averages (1007) the phase modulated signal to simulate an FM signal. As briefly mentioned above, the transmitting device preferably employs a tuned resonant circuit to filter, and thereby average, the phase modulated signal. The tuned resonant circuit employed in the preferred embodiment may suitably comprise a resonant circuit and drive circuit, such as those described in co-pending, commonly-assigned U.S. patent application Ser. No. 08/956,732. The transmitting device then transmits (1009) the simulated FM signal, and the logic flow ends (1011).

The transmitting device transmits the simulated FM signal primarily via a magnetic field at a carrier frequency of about

ten kilohertz or less. In the preferred embodiment, a carrier frequency of 8.192 kilohertz is used. The use of both a low frequency carrier and magnetic coupling allows the transmitting signal to escape substantially electrically shielded enclosures, such as automobile trunks, automobile hoods, or automobile fuel inlets, and provides for a fairly well constrained transmission range due to the mathematical relation that magnetic coupling decreases in proportion to the cube of the distance from the magnetic source. The transmission range of the transmitting device in the preferred embodiment remains nearly constant regardless of whether the transmitting device is transmitting from a shielded enclosure or not due to its use of magnetic coupling to convey the information. By contrast other wireless radio frequency identification (RFID) systems, such as the "SPEEDPASS" fuel vending system, utilize high frequency electromagnetic transmissions which have varying ranges due to their use of both electric and magnetic fields to convey a signal. In order for a transmitting device using both electric and magnetic fields to transmit from an electrically shielded enclosure, a high power transmitter must be employed to generate a magnetic field component strong enough to be detected outside the shielded enclosure. However, when such a high power transmitter is employed and the shielded enclosure is temporarily removed (e.g., when a trunk is open), the transmission range of the transmitter increases dramatically because the shielding is removed and both the electric and magnetic fields convey information. Furthermore, by using a method as described in blocks 1003-1009 to generate the signal to be transmitted, the complex circuitry typically required for FM modulation is not necessary; thus, inexpensive, small scale integrated (SSI) circuits can be used to produce the simulated FM signal.

FIG. 11 is a logic flow diagram 1100 illustrating steps executed by a receiving device to receive digital information, such as that generated and transmitted in accordance with FIG. 10. The logic flow begins (1101) when the receiving device, which is preferably located outside the substantially electrically shielded environment, receives (1103) the simulated FM signal from the transmitting device. The receiving device averages (1105) the received signal using a tuned resonant circuit, such as the resonant circuit and drive circuit described in U.S. patent application Ser. No. 08/956,732, to more closely emulate a true FM signal. Since an FM signal is now effectively present, the receiving device FM detects (1107) the transmitted digital information from the averaged signal, and the logic flow ends (1109). Therefore, in sum, by using the novel signal generation technique described in FIG. 10 and by employing tuned resonant circuits in both the transmitting device and the receiving device, simple microcontroller-based FM detection techniques may be employed in the receiving device to detect the digital information present in the transmitted signal, without requiring complex FM generation circuits to be employed by the transmitting device to produce the original FM signal. By further using low frequency magnetic field transmissions, the present invention permits inexpensive transmission of digital information through electrically shielded enclosures, while maintaining a relatively fixed transmission range under all conditions.

FIG. 12 is a logic flow diagram 1200 illustrating steps executed by a product vending system to vend a product in accordance with the present invention. The logic flow begins (1201) when the product vending system disables (1203) a product dispenser from processing received radio signals. In a preferred embodiment, as described above, the product vending system employs a jamming circuit 44 to produce

jamming signals at a receive frequency of the dispenser's receiver to thereby prevent the receiver from receiving radio signals while the dispenser 18 is in close proximity to the jamming circuit 44. The use of a jamming circuit is preferred over the use of a limit switch, proximity sensor, or other device because a jamming circuit is reliable and requires minimal electrical and mechanical modifications to an existing product vending device (e.g., the jamming circuit can be attached to the external surface of the existing vending device).

In an alternative embodiment, the product vending system's transaction controller may disable power to the dispenser receiver when the dispenser is physically in contact with its retainer 48. For example, one or more limit switch-type electrical contacts could be provided between the dispenser and its retainer when the dispenser is connected to, or placed on or in, its retainer 48. However, such an approach has disadvantages when the dispenser and retainer are intended for use in undesirable environmental conditions, such as outside fuel pump vending machines, that may result in corrosion of electrical contacts and subsequent failing of the disablement circuit. In addition, such an embodiment could result in the false reception of a signal from a receptacle receiver 50 located on the side of the product vending machine opposite the side on which the dispenser transceiver 22 is responsible for servicing.

The product vending system determines (1205) a parameter associated with each received radio signal. When the dispenser 18 is in close proximity to the jamming circuit 44, the dispenser receiver receives a jamming code from the jamming circuit 44 and the product vending system determines that no vending is to take place. However, when the dispenser 18 is moved in close proximity to a receptacle 51 of the product to be vended, the product vending system determines that another signal is now being received and determines a parameter of the newly received radio signal.

In the preferred embodiment, the signal parameter determined by the vending system is signal strength because once the signal strength of the radio signal detected by the product vending device is strong enough to overcome the signal strength of the jamming signal, the product vending device can detect the presence of a receptacle transmitter or transceiver 50, thereby indicating that vending may need to take place. Thus, upon determining the parameter of the received signal, the product vending system determines (1207) whether a receptacle for the product is within a predetermined proximity of the dispenser 18. In the preferred embodiment, this determination is made when the dispenser 18 is in sufficient proximity of the fuel inlet 51 to receive a signal from the receptacle transceiver 50 mounted in physical proximity to the fuel inlet 51. The product vending system thus determines that the receptacle 51 is in a predetermined proximity of the dispenser 18 based on the signal strength of the signals received by a receiver (e.g., a receive portion of the dispenser transceiver 22) of the product vending system. That is, as discussed above, when only the jamming signal is detectable (i.e., has a strong enough signal strength to prevent reception of any other signals at the dispenser receiver), the product vending system presumes that the receptacle 51 is not within a predetermined proximity of the dispenser 18; whereas, when the radio signal transmitted by a transmitting device (e.g., a transmit portion of the receptacle transceiver 50) in or near the receptacle is detectable (i.e., has a sufficient signal strength to be detected over the jamming signal), the product vending system determines that the receptacle 51 is within sufficient proximity of the dispenser 18 (in the preferred embodiment, less than two meters) to permit vending of the product.

When the receptacle 51 is not within sufficient proximity of the dispenser 18 to permit vending of the product, the logic flow returns to block 1203 and the dispenser 18 remains disabled. However, when the receptacle 51 is within sufficient proximity of the dispenser 18 to enable vending of the product, the product vending system determines (1209) whether the received radio signal satisfies at least one predetermined condition relating to a product vending transaction. For example, when the product vending system receives a signal that is not a jamming signal, the product vending system determines whether the received signal includes billing information for a consumer to be charged for the product. That is, the product vending system determines whether the received radio signal includes a credit card account number, a debit card account number, or some other account number to facilitate payment for the product to be vended. In addition to determining whether or not the radio signal at least includes billing information, the product vending system also preferably determines the validity of billing the account provided in the radio signal, for example by determining whether the radio signal also includes information related to the expiration date of the account (e.g., an expiration date of a credit card).

If a received radio signal does not satisfy all the necessary predetermined conditions (e.g., does not include a billing account number and/or does not include a valid expiration date), the logic flow returns to block 1203 and the dispenser 18 remains disabled. However, in the event that the radio signal does satisfy all the necessary predetermined conditions, the product vending system generates a signal to enable (1211) the product dispenser 18 to dispense the product to the receptacle 51, and the logic flow ends (1213).

FIG. 13 is a logic flow diagram 1300 illustrating steps executed to acquire a product from a vending device in accordance with the present invention. The logic flow begins (1301) when a transmitter or transceiver apparatus located in, near, or substantially adjacent to a receptacle for the product stores (1303) billing information in a memory device, such as a read-only memory, a random access memory, or any other memory device. Some time after the billing information is stored in the memory device, the apparatus generates (1305) a radio signal that includes the billing information. In a preferred half-duplex embodiment, the radio signal is generated in response to an interrogation signal that requests the billing information. Such a half-duplex system is described in more detail below with respect to FIGS. 15 and 16. In an alternative simplex system, the apparatus continually or periodically generates the radio signal. In the preferred embodiment, the billing information is encrypted during generation of the radio signal using any one of a variety of known encryption techniques to prevent unintended receivers from receiving such critical information of a consumer.

Once the radio signal is generated, the apparatus transmits (1307) the radio signal from a transmitter (e.g., a transmit portion of the receptacle transceiver 50) locatable within a substantially electrically shielded enclosure physically associated with (e.g., adjacent to) the receptacle 51 for the product. In the preferred embodiment, the radio signal is generated and transmitted in accordance with the method described above with respect to FIG. 10. Additionally, in the preferred vending system discussed above with respect to FIG. 1, the transmitter is located in the trunk of a vehicle substantially adjacent to the receptacle or fuel inlet 51 for receiving fuel from a fuel dispenser 18.

Subsequent to transmitting the radio signal, provided all analysis of the billing information was acceptable, the receptacle receives (1309) the product, and the logic flow ends (1311).

FIG. 14 is a logic flow diagram 1400 illustrating steps executed in a product vending system to vend a product in accordance with the present invention. The logic flow begins (1401) when a consumer or an attendant positions (1403) a receiver (e.g., a receive portion of the dispenser transceiver 22) associated with the product dispenser 18 proximate to a transmitter (e.g., a transmit portion of the receptacle transceiver 50) located in or substantially near a receptacle 51 for the product. The receiver must be positioned sufficiently close to the transmitter to permit the receiver to receive a radio signal from the transmitter. However, in a preferred embodiment in which the radio signal is conveyed via a low frequency (about ten kilohertz or less) magnetic field and in which the transmitter is located substantially adjacent to the receptacle, the consumer need only position the dispenser in or near the receptacle (as the consumer would ordinarily do anyway) to allow the receiver to receive the radio signal transmitted by the transmitter.

Once the receiver is positioned appropriately, the receiver receives (1405) the radio signal from the transmitter, wherein the transmitter is located within a substantially electrically shielded enclosure adjacent to a receptacle of the product. Upon receiving the radio signal from the transmitter, the receiver demodulates the transmitted signal to recover the digital information included therein and provides the digital information to a transaction controller of the product vending system. The transaction controller then determines (1407) whether the radio signal included billing information for a consumer to be charged for the product. The vending system's transaction controller makes this determination by comparing the digital information provided by the receiver to stored account numbers in a centralized computer database. For example, upon receiving a string of bits from a receiver, the transaction controller determines whether those bits correspond to a credit card account number, a debit account number or some other bank account number and determines further whether the bits contain account validity information, such as credit card expiration date. In the preferred embodiment, transaction controller determines whether the radio signal includes billing information by extracting the bit sequence from the radio signal with the assistance of the receiver and determining whether the bit sequence correlates to a predetermined bit sequence. That is, the transaction controller uses well known correlation techniques to effectively compare the bit sequence of the radio signal with other known bit sequences, such as credit card account numbers, debit card account numbers or other bank account numbers. When the bit sequence correlates to one of the predetermined bit sequences, transaction controller determines that the radio signal does indeed include billing information for a consumer to be charged for the product.

When the radio signal does not include billing information, no product is dispensed and the logic flow ends (1413). However, when the radio signal does include billing information, the transaction controller extracts the billing information and determines (1409) whether the billing information satisfies one or more predetermined conditions as discussed above with respect to FIG. 12. That is, the transaction controller determines whether the billing information is valid (e.g., by checking account validity information contained in the radio signal or by verifying account validity via a wireline communication with a POS computer as is well known in the art). When the billing information does not satisfy one or more of the predetermined conditions, no product is dispensed, and the logic flow ends (1413). When the billing information does satisfy all the

predetermined conditions, the transaction controller generates (1411) a signal enabling the product dispenser to dispense the product as described above with reference to FIG. 9, and the logic flow ends (1413).

FIG. 15 is a logic flow diagram 1500 illustrating steps executed by a product vending device to vend a product in accordance with the preferred embodiment of the present invention. The logic flow begins (1501) when the vending device transmits (1503) an interrogation signal that includes a request for billing information of a consumer to be charged for the product vend. Provided that the interrogation signal is received by a transceiver associated with a receptacle for the product, the vending device eventually receives (1505) a radio signal from the transceiving device. Upon reception of the radio signal, the vending device determines (1507) whether the radio signal includes billing information of a consumer to be charged for the product. As discussed above, such a determination is preferably accomplished by extracting a bit sequence (e.g., a preamble, an acknowledgment, or an account number) from the radio signal and determining whether the bit sequence correlates to a predetermined bit sequence. In a preferred embodiment, the vending device and the transceiving device associated with the receptacle for the product utilize a preestablished protocol in which a preamble is included at the beginning of the bit stream transmitted by the transceiving device in response to the interrogation signal. Accordingly, the vending device, upon receiving the radio signal, correlates the preamble (e.g., first 16 bits of the bit stream) extracted from the radio signal with a preamble stored in a memory of the vending device. When the received preamble correlates to the predetermined preamble (e.g., when a magnitude of the correlation between the received preamble and the predetermined preamble exceeds a predetermined magnitude threshold), the vending device determines that the radio signal includes billing information of the consumer.

If the radio signal does not include billing information of the consumer, no product is dispensed, and the logic flow ends (1513). However, if the radio signal does include billing information for a consumer, the vending device determines (1509) whether the billing information satisfies one or more predetermined conditions. That is, once the vending device determines that the radio signal includes billing information via the preamble, the vending device determines whether some or all of the remaining bits of the received bit stream meet certain other criteria, such as being a valid account number and/or indicating a valid expiration date for the account. For example, the vending device upon determining that the radio signal includes billing information might examine the next set of bits to determine whether they satisfy a known mathematical algorithm used by credit and debit card issuers to verify valid account numbers. In the preferred embodiment, the vending device performs this account verification by processing the bits, extracting the account digits, and sending the account number to a particular creditor (also identified in the bit stream represented by the radio signal) for verification. A similar process might be used to verify account expiration date.

If the billing information does not satisfy the predetermined conditions (e.g., does not indicate a valid account number and/or a valid expiration date), no product is dispensed, and the logic flow ends (1513). If the billing information does satisfy the predetermined conditions, the vending device dispenses (1511) the product to the receptacle for the product, and the logic flow ends (1513). Therefore, as described above with respect to blocks 1501-1513, the present invention provides a half duplex

system for facilitating cashless vending of products. In sharp contrast to the prior art, such as the "SPEEDPASS" fuel vending system, which provides for simplex operation only (i.e., only a receiver at the vending device and only a transmitter associated with the consumer for the product), the present invention provides a more secure and efficient vending system by requiring transmission of critical information, such as a consumer's credit card number, only in response to a request for such information from the vending device from which a product is desired, instead of continuous transmission of the information as in the prior art. Improved efficiency results from the use of a half duplex system because transmitters, which generally consume the largest amount of power in a transceiver, only need to operate for one short period of time responsive to a request for information.

FIG. 16 is a logic flow diagram 1600 illustrating steps executed to acquire a product from a vending device in accordance with a preferred embodiment of the present invention. The logic flow begins (1601) when a transceiver associated with, and preferably adjacent to, a receptacle for the product receives (1603) an interrogation signal from the vending device that includes a request for billing information for a consumer to be charged for the product. Responsive to the interrogation signal, the transceiver transmits (1605) a radio signal that includes the billing information. In the preferred embodiment, the radio signal is generated in accordance with the method described above with respect to FIG. 10. Provided that the vending device receives and satisfactorily processes the radio signal, the receptacle for the product receives (1607) the product from the vending device, and the logic flow ends (1609).

While the foregoing constitute certain preferred and alternative embodiments of the present invention, it is to be understood that the invention is not limited thereto and that in light of the present disclosure, various other embodiments will be apparent to persons skilled in the art. Accordingly, it is to be recognized that changes can be made without departing from the scope of the invention as particularly pointed out and distinctly claimed in the appended claims which shall be construed to encompass all legal equivalents thereof.

What is claimed is:

1. A method for vending a product from a dispenser to a receptacle for the product, the method comprising the steps of:

disabling the dispenser from processing a received radio signal until the receptacle is located within a predetermined proximity of the dispenser, said step of disabling comprising the step of transmitting a jamming signal to inhibit reception of the radio signal until the receptacle is within the predetermined proximity of the dispenser; and

enabling the dispenser to dispense the product in response to reception of at least one said radio signal that satisfies at least one predetermined condition relating to a product vending transaction.

2. The method of claim 1, further comprising the step of determining that the receptacle is located within the predetermined proximity of the dispenser based on a parameter associated with the radio signal.

3. The method of claim 2, wherein the parameter associated with the radio signal comprises a signal strength of the radio signal sufficient to permit reception of the radio signal at the dispenser.

4. A method for vending a product from a product dispenser, the method comprising the steps of:

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transmitting a radio signal, by a first transmitter locatable within a substantially electrically shielded environment physically associated with a receptacle for the product, the radio signal representing billing information of a consumer to be charged for the product;

positioning a receiver associated with the product dispenser in sufficient proximity to the first transmitter to permit the radio signal to be received by the receiver; determining whether the billing information satisfies at least one predetermined condition;

generating a signal that enables the product dispenser to dispense the product in response to determining that the billing information satisfies the at least one predetermined condition and

transmitting, by a second transmitter located in a predetermined proximity of the product dispenser, a jamming signal that prevents the receiver from receiving the radio signal when the receiver is in proximity of the second transmitter.

5. The method of claim 4, wherein the step of transmitting a radio signal comprises the step of transmitting the radio signal responsive to the reception of an interrogation signal that includes a request for the billing information.

6. The method of claim 5, further comprising the step of receiving, by a receiver located within the substantially electrically shielded environment, the interrogation signal from a second transmitter associated with the product dispenser prior to the step of transmitting the radio signal.

7. The method of claim 4, further comprising the step of transmitting, by a second transmitter associated with the product dispenser, an interrogation signal, the interrogation signal including a request for billing information.

8. The method of claim 7, wherein the step of transmitting an interrogation signal comprises the step of repeatedly transmitting the interrogation signal.

9. The method of claim 4, wherein the step of transmitting a radio signal comprises the steps of:

generating a constant frequency signal;

producing a phase modulated signal by varying a phase of the constant frequency signal over a period of time to represent the billing information;

averaging the phase modulated signal to produce a simulated frequency modulated signal; and

transmitting the simulated frequency modulated signal.

10. The method of claim 9, wherein the billing information consists of a plurality of bits and wherein the step of producing a phase modulated signal comprises the steps of:

transitioning from a first phase to a second phase during a first portion of a bit transmission period; and

transitioning from the second phase to a third phase during a second portion of the bit transmission period, thereby representing one bit of the billing information as at least two phase transitions.

11. The method of claim 4, wherein the step of transmitting a radio signal comprises the step of transmitting the radio signal primarily via a magnetic field at a carrier frequency of about ten kilohertz or less.

12. The method of claim 4, further comprising the step of encrypting the billing information prior to the step of transmitting a radio signal.

13. A method for a product dispenser to vend a product to a consumer, the method comprising the steps of:

receiving a radio signal from a transmitter located within a substantially electrically shielded environment physically associated with a receptacle for the product;

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determining whether the radio signal includes billing information for a consumer to be charged for the product;

in response to determining that the radio signal includes billing information, determining whether the billing information satisfies at least one predetermined collection;

generating a signal that enables the product dispenser to dispense the product in response to determining that the billing information satisfies the at least one predetermined condition, and

receiving a jamming signal that prevents the product dispenser from receiving the radio signal when the product dispenser is not in sufficient proximity to the transmitter.

14. The method of claim 13, further comprising the step of positioning the product dispenser in sufficient proximity to the transmitter to permit reception of the radio signal prior to the step of receiving a radio signal.

15. The method of claim 13, further comprising the step of transmitting an interrogation signal prior to the step of receiving a radio signal, the interrogation signal including a request for the billing information.

16. The method of claim 15, wherein the step of transmitting an interrogation signal comprises the step of repeatedly transmitting the interrogation signal.

17. The method of claim 16, wherein the step of determining whether the radio signal includes billing information comprises the steps of:

extracting a bit sequence from the radio signal; determining whether the bit sequence correlates to a predetermined bit sequence; and

in response to determining that the bit sequence correlates to a predetermined bit sequence, determining that the radio signal includes billing information for a consumer to be charged for the product.

18. The method of claim 13, wherein the billing information comprises a plurality of bits, the method further comprising the step of detecting each bit of the billing information based on at least one phase variation of the radio signal.

19. The method of claim 13, wherein the step of receiving a radio signal comprises the step of receiving the radio signal at a receiver positioned outside the substantially electrically shielded environment.

20. A method for a product receptacle to acquire a product from a product dispenser, the method comprising the steps of:

storing billing information for a consumer to be charged for the product;

generating a radio signal that includes the billing information; transmitting

the radio signal from a transmitter located within a substantially electrically shielded environment physically associated with the product receptacle;

transmitting a jamming signal operable to inhibit reception of the radio signal until the receptacle is within sufficiently close proximity of the dispenser as to enable the radio signal to be received notwithstanding said jamming signal, and

acquiring the product from the product dispenser into the receptacle responsive to reception of the radio signal.

21. The method of claim 20, wherein the step of generating the radio signal further comprises the step of encrypting the billing information.

22. The method of claim 20, further comprising the step of receiving an interrogation signal from the product dispenser prior to the step of generating a radio signal, the interrogation signal including a request for the billing information. 5

23. The method of claim 20, wherein the step of generating a radio signal comprises the steps of:

generating a constant frequency signal;
varying a phase of the constant frequency signal over a period of time to represent the billing information, thereby producing a phase modulated signal; and averaging the phase modulated signal to produce a simulated frequency modulated signal. 10

24. The method of claim 23, wherein the billing information is represented by a plurality of bits and wherein the step of varying a phase of the constant frequency signal comprises the steps of:

transitioning from a first phase to a second phase during a first portion of a bit transmission period; and transitioning from the second phase to a third phase during a second portion of the bit transmission period, thereby representing one bit of the billing information as at least two phase transitions. 20

25. The method of claim 20, wherein the step of transmitting the radio signal comprises the step of transmitting the radio signal primarily via a magnetic field at a carrier frequency of about ten kilohertz or less. 25

26. A method for dispensing a product from a product dispenser into a receptacle, the method comprising the steps of:

storing billing information for a consumer to be charged for the product;

generating a radio signal that includes the billing information; 35

transmitting the radio signal from a transmitter located within a substantially electrically shielded environment physically associated with the product receptacle;

transmitting, from a location other than one within said environment, a jamming signal operable to inhibit reception of the radio signal until the receptacle is within sufficiently close proximity of the dispenser as to enable the radio signal to be received notwithstanding the jamming signal; 40

receiving the radio signal outside the substantially electrically shielded environment; and

enabling the product to be dispensed in response to receiving the radio signal. 45

27. The method of claim 26, wherein the step of generating the radio signal further comprises the step of encrypting the billing information. 50

28. The method of claim 26, further comprising the step of receiving an interrogation signal from the product dispenser prior to the step of generating a radio signal, the interrogation signal including a request for the billing information. 55

29. The method of claim 26, wherein the step of generating a radio signal comprises the steps of:

generating a constant frequency signal;
varying a phase of the constant frequency signal over a period of time to represent the billing information, thereby producing a phase modulated signal; and averaging the phase modulated signal to produce a simulated frequency modulated signal. 60

30. The method of claim 29, wherein the billing information is represented by a plurality of bits and wherein the

step of varying a phase of the constant frequency signal comprises the steps of:

transitioning from a first phase to a second phase during a first portion of a bit transmission period; and transitioning from the second phase to a third phase during a second portion of the bit transmission period, thereby representing one bit of the billing information as at least two phase transitions. 5

31. The method of claim 26, wherein the step of transmitting the radio signal comprises the step of transmitting the radio signal primarily via a magnetic field at a carrier frequency of about ten kilohertz or less. 10

32. A method for a product vending device to vend a product to a receptacle for the product, the method comprising the steps of:

transmitting an interrogation signal that includes a request for billing information of a consumer to be charged for the product;

responsive to the interrogation signal, receiving a radio signal;

determining whether the radio signal includes the billing information;

in response to determining that the radio signal includes the billing information, determining whether the billing information satisfies at least one predetermined condition;

enabling the product to be dispensed from the product vending device in response to determining that the billing information satisfies the at least one predetermined condition, and

transmitting a jamming signal operable to inhibit reception of the radio signal unless the vending device and the receptacle are within sufficiently close proximity of one another to enable the radio signal to be received notwithstanding the jamming signal, and responsive to reception of the radio signal, receiving the product. 35

33. A method for acquiring a product from a vending device, the method comprising the steps of:

receiving an interrogation signal from the vending device, the interrogation signal requesting billing information for a consumer to be charged for the product;

responsive to the interrogation signal, transmitting a radio from a transmitter located within a substantially electrically shielded environment physically associated with a product receptacle signal that includes the billing information;

transmitting, from a location other than one within said environment, a jamming signal operable to inhibit reception of the radio signal until the receptacle is within sufficiently close proximity of the vending device as to enable the radio signal to be received notwithstanding the jamming signal, and

responsive to reception of the radio signal, receiving the product. 40

34. An apparatus for controlling dispensing of a product, the apparatus being attachable to a product dispenser, the apparatus comprising:

a card reading device that, in response to obtaining billing information for a consumer to be charged for the product, provides the billing information to a creditor of the consumer;

a receiver for receiving a radio signal from a transmitter associated with a receptacle for the product;

a card reader interface, operably coupled to the receiver and the card reading device, that determines whether

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the radio signal includes billing information for the consumer to be charged and, in response to determining that the radio signal includes the billing information, converts the billing information received from the receiver into a format compatible with the card reading device and generates a control signal to enable the product dispenser to dispense the product, and

a jamming circuit, coupled to the card reader interface, that transmits a jamming signal to prevent the receiver from receiving the radio signal until at least a portion of the product dispenser is in sufficient proximity to the receptacle to permit reception of the radio signal.

35. The apparatus of claim **34**, further comprising a transmitter, operably coupled to the card reader interface, that transmits, responsive to at least one control signal from the card reader interface, at least one interrogation signal that includes a request for the billing information.

36. A system for vending a product from a dispenser to a receptacle for the product, the system comprising:

a transaction controller that generates control signals to facilitate dispensing of the product;

a first transmitter, operably coupled to the transaction controller and forming a part of the dispenser, that transmits an interrogation signal responsive to a control signal from the transaction controller, the interrogation

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signal including a request for billing information of a consumer to be charged for the product;

a first receiver, locatable in a substantially electrically shielded environment that is physically associated with the receptacle, that receives the interrogation signal;

a second transmitter, operably coupled to the first receiver, that transmits a radio signal responsive to receipt of the interrogation signal, the radio signal including the billing information;

a second receiver, operably coupled to the transaction controller, that receives the radio signal, demodulates the radio signal to recover the billing information, and provides the billing information to the transaction controller, and

a jamming circuit located substantially adjacent to a retainer of the dispenser, that generates and transmits a jamming signal to prevent the second receiver from receiving the radio signal when the dispenser is positioned proximate to the retainer.

37. The apparatus of claim **36**, wherein the product is fuel and wherein the receptacle for the product is a portion of a motorized vehicle.

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